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EPIDEMIOLOGICAL EVALUATION OF HEALTHCARE ASSOCIATED INFECTIONS IN THE CLINIC OF ORAL AND MAXILLO-FACIAL SURGERY "SF.SPIRIDON" EMERGENCY CLINICAL HOSPITAL IASI, ROMANIA

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ABSTRACT. The **aim** of this study was to evaluate epidemiological data on healthcare-associated infections in Oral and Maxillo-Facial Surgery Clinic of the "Sfântul Spiridon" Emergency Clinical Hospital in Iași between 2011 and 2018. **Material and methods**. A retrospective study on HAI between 2011 and 2018 was initiated at the Oral and Maxillo-Facial Surgery Clinic of the "Sfântul Spiridon" Emergency Clinical Hospital in Iași. **Results**. Among 21277 surveyed patients the prevalence of patients with at least one HAI was 0,72%. The types of diagnosed HAI were the surgical site infections (54,11%), respiratory infections (15,58 %), device associated infections (14,29%), digestive tract infections (5,63%), urinary tract infections (5,63%), septicemia (2,16%) and cutaneous infections (1,73%).**Conclusions**. The assessment of the epidemiologic data, risk factors and trends of healthcare-associated infections are necessary for their surveillance, control and prevention.

Key words*:* Healthcare-associated infections, prevalence, oral surgery.

INTRODUCTION

Healthcare-associated infections (HAI), also known as nosocomial infections, are currently the most common complications affecting hospitalized patients (1). According to the U.S. Centers for Disease Control and Prevention (CDC), they are defined as infections that occur within 48 to 72 hours of hospitalization, within 10 days of discharge or up to 30 days after surgery (2,3). The occupational infectious pathology among the medical staff is also included in the HAI category.

The impact of nosocomial infections is associated with long-term disability, increased bacterial antibiotic resistance, the rising of the healthcare costs for patients and healthcare facilities and a significant increase of the mortality rates. (4)

CDC surveillance data highlight that nearly 1,7 million hospitalized patients are annual affected by an HAI while being treated for other health problems (5). In the United States the Government Agency for Research and Quality Assurance in

Health Care reports that nosocomial infections are in the top 10 causes of death, one in 17 HAI diagnosed patients dying as a result of such an infection (6).

The European Center for Disease Control and Prevention reported in 2018 in a point prevalence survey in 2016 and 2017 that 4,5 million healthcare-associated infections were estimated to occure affecting 98.000 (1/15) hospital patients. The frequency of nosocomial infections is significantly higher in countries with small and medium income than in those with an increased quality of life index. In 100 hospitalized patients the frequency of HAI increases from 7 in developed countries, to 10 in countries with low socio-economic status (7). In Europe, the prevalence rate of HAI in hospital conditions varies between 4,6% and 9,3% (8). It is estimated that approximately 30% of patients in intensive care units are affected by at least one such infection. In the United States, the estimated HAI incidence rate was of 4,5%, corresponding to 1,7 million affected patients.On average, the hospitalization period for patients with HAI is 2,5 times longer than for those who do not suffer such an infection (3).

Four types of infections account for more than 80% of HAI: urinary tract infections (mainly following the use of a urinary catheter), surgical site infections (SSI), bacteremia (most often associated with the use of an intravascular device) and pneumonia (during assisted respiration). Infections of the digestive system, skin and sepsis are also, but less commonly, reported (9,10) Surgical site infections (SSIs) following head and neck cancer surgery may occur in as many as 10–45% of cases despite antibiotic prophylaxis (11,12).

The risk factors for HAI vary depending on the provided healthcare, level of endowment of the medical facility and the level of finacial resources of the healthcare systems. Those risk factors are the age over 65 years, emergency hospitalization or in intensive care units, hospitalization period over 7 days, the use of medical devices like venous or urinary catheter, endotracheal intubation, immunosuppression by prolonged corticosteroid treatment, neutropenia and drastically disease progression. In low and middle-income countries, risk factors as poor infection control practices, lack of financial resources, inadequate hygiene, lack of trained staff and appropriate equipment are added (13).

Although significant progress has been made in preventing some types of HAI their reported frequency of is worrying worldwide. The CDC, in partnership with the World Health Organization make significant efforts in order to adopt specific strategies for reducing the incidence of HAI by planning, implementing, supporting and evaluating programs for the prevention and control of infectious diseases (14). It is estimated that one third of HAI can be prevented by rigorously assessing risk factors and by the medical staff education in order to strictly adopting infection control protocols (15,16). In Romania, these regulations at national level are included in the Order of the Minister of Health no. 1101/2016 on the Norms for surveillance, prevention and limitation of the infections associated with healthcare (17).

Studies in the literature have shown that invasive procedures, as those requared by oral and maxillofacial surgery, increase the risk of HAI, especially in patients with impaired immune status (18).

MATERIAL AND METHODS

A retrospective study on HAI between 2011 and 2018 was initiated at the Oral and Maxillo-Facial (OMF) Surgery Clinic of the "Sfântul Spiridon" Emergency Clinical Hospital in Iași based on a baseline of 21277 hospitalised patients. HAI detection was performed by active epidemiological surveillance.The data were obtained by accessing the database of the Surveillance and Prevention of Healthcare-associated infections Department (HAI reporting sheets, statistical reports, epidemiological and bacteriologica investigations).

The HAI cases were analyzed in correlation with the data from the Clinical Observation Sheets of the patients from the archive of the Oral and Maxillo-Facial Surgery Clinic of the Emergency Clinical Hospital "Sfântul Spiridon" Iași. Relative proportions were calculated as each infection site versus total HAIs per year. The results were also evaluated in relation with the gender of the patients.

Statistical analysis of the data was performed using the SPSS 20 system (SPSS Inc., Chicago, IL, USA). The Chi-square and Fisher tests were used to compare the variables. Statistical significance was set at $p < 0.05$.

RESULTS

A total number of 231 healhcare-associated infections in the OMF Surgery Clinic of the Emergency Clinical Hospital "Sf. Spiridon" Iași were reported between 2011 and 2018. The nosocomial infections were identified in 154 hospitalized patients. Of these 118 (76,63%) were men and 36 (23,37%) were women. The patients mean age was of 57,6.

183 (79,22%) of the 231 HAI were recorded in patients hospitalised due to tumoral pathology**,** 17 (7,35%) for traumatic injures and 18 (7,79%) for suppurative conditions.

The prevalence of the patients diagnosed with at least one HAI from the total number of hospitalized patients between 2011 and 2018 was of 0,72% ranging from 0,47% in 2011to 1,08% in 2017 (table I).

Table I - Patients diagnosed with HAI distribution by year

Year	Patients diagnosed with HAI	Total number of patients	Prevalence %
2011	12	2543	0,47
2012	16	2584	0,62
2013	21	2928	0,72
2014	16	3017	0,53
2015	24	2917	0,82
2016	23	2732	0,84
2017	25	2325	1,08
2018	17	2231	0,76
TOTAL	**154**	**21277**	**0,72**

The most common diagnosed HAI during the investigated period were the SSI (54,11%), followed by respiratory infections (tracheobronchitis and bronchopneumonia) (15,58 %). Other recorded types of HAI were: device associated infections (venous catheter) (14,29%), digestive tract infections (5,63%), urinary tract infections (5,63%), septicemia (2,16%) and cutaneous infections (1,73%) (fig.1).

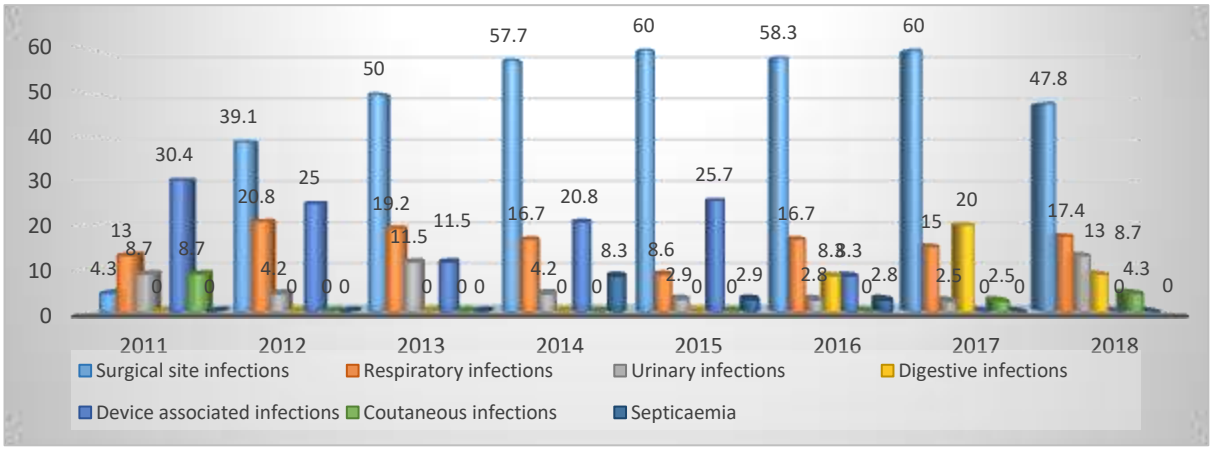

Figure 1.Types of healthcare-associated infections 2011-2018

The evaluation of different types of HAI proportion by year in the investigated period showes that surgical site infections ranged from 4,3% in 2011 and 60% in 2015 and 2017 (fig.2). 29 (23,20%) surgical site infections were diagnosed in female and 96 (76,80%) in male patients.

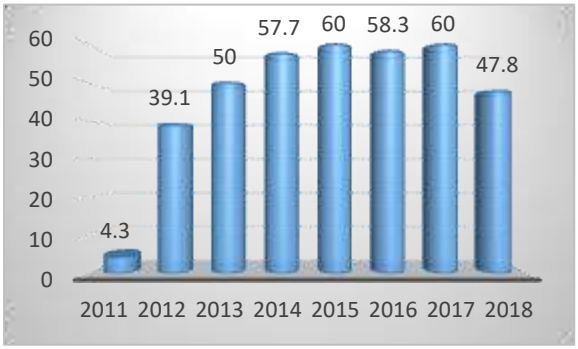

Figure 2. Surgical site infections proportion from total HAI (2011-2018)

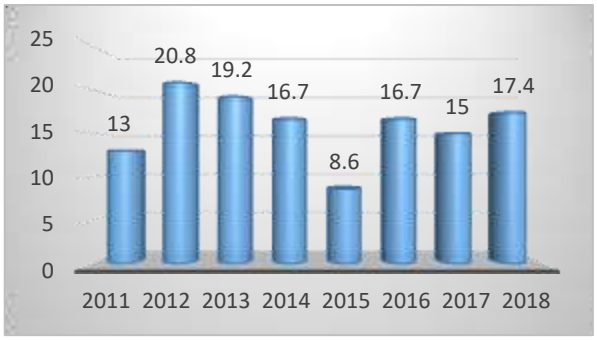

Figure 3. Respiratory tract infection proportion from total HAI (2011-2018)

The respiratory tract infection proportion from total HAI ranged from 8,6 % in 2015 and 20,8% in 2012 (fig. 3). 28 (77,78%) of 36 such infections were reported in male and 8 (22,22%) in female patients.

The urinary tract infections proportion from total HAI ranged from 2,5 % in 2017 and 13,0 % in 2018 .(fig. 5). From the 13 such infections 7 (53,85%) were diagnosed in female and 6 (46,15%) in male patients. The same distribution by gender was reported for the digestive tract infections.

Digestive tract infections were reported in three years (2016-2018) from the investigated period. Their proportion from total HAI ranged from 8,3% (2016) to 20% (2018) (fig.5).

Figure 4.Urinary tract infections proportion from total HAI (2011-2018)

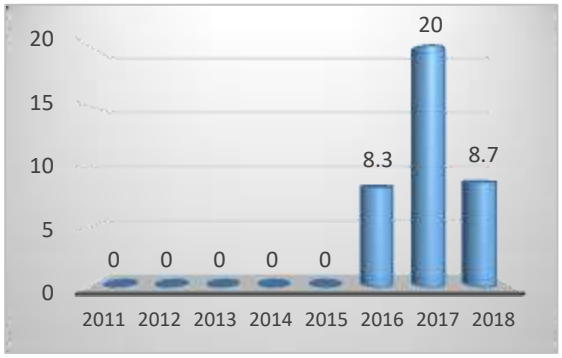

Figure 5. Digestive tract infections proportion from total HAI (2011-2018)

The device associated infections (intravenous catheter) were recorded in 2011 - 2016 period. Their proportion from total HAI ranged from 8,3 % in 2016 and 30,4 % in 2011. (fig.6) From 33 such infections 29 (87,88%) were reported in men and 4 (12,12%) in women.

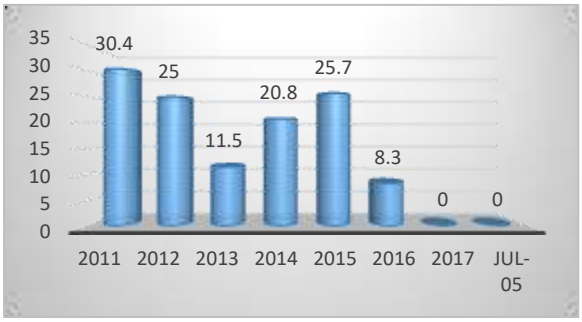

Figure 6. Device associated infections proportion from total HAI (2011- 2018)

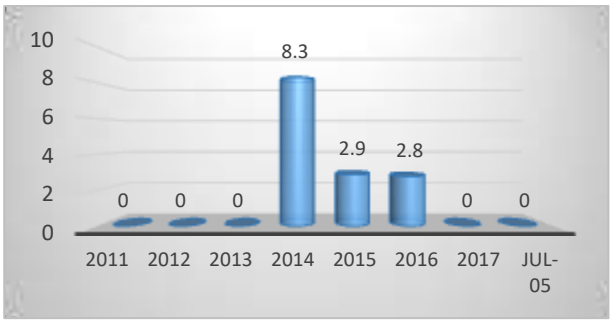

Figure 7. Septicemia proportion from total HAI (2011-2018)

Severe healthcare-associated infections (septicemia) were reported in three years from the investigated period (2014-2016) with a proportion between 2,8% in 2016 and 8,3% in 2014 from total HAI number (fig.7). 40% of such infections were reported in female and 60% in male pacients.

Cutaneous infections were diagnosed in 2011, 2017 and 2018 with a proportion from total HAI between 2,5% in 2017 and 8,7% in 2011. All those infections were recorded in male pacients.

Women were mainly exposed to urinary and digestive infections while for men the most frequent HAI were the surgical site infections, respiratory infections and infections associated to medical devices

DISCUSSIONS

The high global prevalence of healthcare associated infections (HAI) is a major health concern regarding the impact on morbidity and mortality as well as on the financial burden for healthcare systems.

The nosocomial infections can be assessed based on prevalence, mortality rate and associated costs. The prevalence of HAI evaluates the patient's healthcare quality and safety but cannot yet be controlled despite all efforts worldwide (19). The results of the present study highlighte an average prevalence of nosocomial infections of 0,72%, a low value compared to those reported in Europe which can be explained by their underreporting.

Numerous studies on HAI have been initiated at national or international level, the results of which provide epidemiological data on the impact of this pathology.The results of our study demonstrate that HAI related to head and neck surgery were mostly associated with tumoral pathology in pacients with an often compromised immune status due to frequent comorbidities. This is the worldwide sixth most common type of cancer acounting about 650,000 new diagnosed cases and 350,000 deaths annually, showing an increasing incidence in the young population (20, 21).

During the investigated period (2011-2018) the most common diagnosed HAI were the SSI (54,11) confirming the HAI profile recorded for middle and low-income countries (incidence average value of 11,8) compared to the reported incidence in developed countries (between 1,2% and 5,2%). SSI are defined as infections occurring up to 30 days after surgery affecting the incision or tissues at the site of the surgical intervention and can cause serious complications as important deterioration of the surgical wound, mucocutaneous fistula, sepsis and death (22). Worldwide SSI rank on the second place as prevalence (20%) and the third place regarding the financial impact by increasing the number of days of hospitalization and the costs of the required specific treatments. Surgical site infections following head and neck cancer surgery may occur in as many as 10–45% of cases despite antibiotic prophylaxis (23).

A systematic review and meta-analysis (2011) funded by World Health Organisation reported a cumulative incidence of SSI of 2 to 6 per 100 surgical procedures as a result of a national level study in the United States of America. In different European countries there were reported 2 to 9 such infections per 100 surgical procedures (e.g.1 to 6 per 100 procedures in Germany) (1). The patients 'gender was a significant risk factor for SSI in the current study, 76,8% of the patients being men. This finding is consistent with the studies of Park et al. in 2016, Belusic-Gobic et al. in 2007 and Lee et al. in 2011 , while other studies have reported significant association with other factors as basic systemic diseases (Schwartz et al., 2004) (24-27).

Urinary tract infections often complicate the evolution of patients admitted in surgery and intensive care units. Those infections, mainly catheter-associated, are the most common HAI

(35%) but have the lowest mortality rate and cause the lowest additional costs in patient care. In the present study, the prevalence of urinary tract infections was relatively low, ranging from 4,2% in 2012 to 13% of HAI infections in 2018. Other studies results reveal a frecvency from 1,2% (Klaus et al, 2001) , 1,6%, (Lizioli et al_, 2003), 8,4% (Nuvials et.al, 2015) to 22,7% (Astrinaki et al, 2017) and 34% (Eriksen et al, 2005) (28-32). The risk factors associated with these infections include increased catheterization time, female gender, length of hospital stay in the intensive care unit and previous antimicrobial therapy (33, 34).

The results regarding other types of HAI reveal a lower proportion of respiratory and digestive infections. Respiratory infections accounted for 15,58% of the total HAI, with values between 8,6% in 2015 and 20,8% in 2012. Prevalence studies in the European Union regarding healthcare-associated pneumonia revealed that, out of the total number of patients included in the research, 1,3% were diagnosed with such infections, with much higher values for patients in intensive care units (8,1%) and for intubated patients (15%) (35). The values reported by different reserchers in the literature vary greatly, from 1,0% (28) to 22,7% (30), 24,8% (36) , and 34% (31) .

Intravenous catheter associated infections (bloodstream infection) counted from 8,3% (2016) to 30,4% (2011) compared to 10,8% value reported by Suetens et al. from two European point prevalence surveys (2018) (8) and Rosenthal et al. (2006) (37). Septicemia as a severe form of HAI with blood transmission was recorded in the present study in 3 years (2014-2016), confirming the data in the literature that mention a low prevalence compared to other types of HAI (38).

CONCLUSIONS

Healthcare-associated infections are one of the leading concerns in public health worldwide, requiring the implementation of strong and sustained strategic and educational initiatives. Epidemiological assessments using standardized methods and effective networks for surveillance are necessary in order to increase the succes in healthcare-associated infections prevention and control.

REFERENCES

1. Benedetta Allegranzi, Sepideh Bagheri Nejad, Christophe Combescure, Wilco Graafmans, Homa Attar, Liam Donaldson, Didier Pittet. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis.The Lancet 2011; 377 (9761): 228-241.
2. Revelas A Niger Healthcare - associated infections: A public health problem.Med J. 2012 A; 53(2):59-64.
3. Haque M, Sartelli M, McKimm J, Abu Bakar M. Health care-associated infections - an overview. Infect Drug Resist. 2018; 11:2321-2333.
4. WHO Healthcare-associated infections. Fact Sheet.2014. http://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf
5. Klevens RM, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA, Cardo DM.Estimating health care-associated infections and deaths in U.S. hospitals, 2002.Public Health Rep.2007; 122(2):160-166.
6. Agency for Healthcare Research and Quality. Patient safety primers: healthcare-associated infections. 2012. https://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/hais/index.html.
7. European Center for Disease Control and Prevention - Healthcare-associated infections-a threat to patient safety in Europe 2017 https://www.ecdc.europa.eu/en/publications-data/infographic-healthcare-associated-infections-threat-patient-safety-europe)
8. Suetens Carl, Latour Katrien, Kärki Tommi, Ricchizzi Enrico, Kinross Pete, Moro Maria Luisa, Jans Béatrice, Hopkins Susan, Hansen Sonja, Lyytikäinen Outi, Reilly Jacqui, Deptula Aleksander, Zingg Walter, Plachouras Diamantis, Monnet Dominique L, The Healthcare-Associated Infections Prevalence Study Group. Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017. Euro Surveill. 2018; 23(46). https://doi.org/10.2807/15607917.ES.2018.23.46.1800516
9. Shi M, Han Z, Qin L, Su M, Liu Y, Li M, Cheng L, Huang X, Sun Z. Risk factors for surgical site infection after major oral oncological surgery: the experience of a tertiary referral hospital in China. J Int Med Res. 2020;48(8): https://doi.org/10.1177/0300060520944072
10. Assael, L. A. Nosocomial infection and fomites in oral and maxillofacial surgery practice. J. Oral Maxillofac. Surg. 2005; 63 (7): 889–890.
11. Yao CM, Ziai H, Tsang G, et al. Surgical site infections following oral cavity cancer resection and reconstruction is a risk factor for plate exposure. J Otolaryngol Head Neck Surg. 2017;46(1):30.

12. Lee DH, Kim SY, Nam SY, Choi SH, Choi JW, Roh JL. Risk factors of surgical site infection in patients undergoing major oncological surgery for head and neck cancer.Oral Oncol.2011;47:528-531.
13. de Melo GM, Ribeiro KC, Kowalski LP, Deheinzelin D. Risk factors for postoperative complications in oral cancer and their prognostic implications. Arch Otolaryngol Head Neck Surg. 2001;127(7):828-833.
14. Allegranzi B, Bischoff P, de Jonge S, Kubilay NZ, Zayed B, Gomes SM, Abbas M, Atema JJ, Gans S, van Rijen M, Boermeester MA, Egger M, Kluytmans J, Pittet D, Solomkin JS; WHO Guidelines Development GroupNew WHO recommendations on preoperative measures for surgical site infection prevention: an evidence-based global perspective Lancet Infect Dis. 2016;16(12):276-287.
15. WHO Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level.2016 ISBN 978-92-4-154992-9. https://www.who.int/gpsc/ipc-components-guidelines/en/
16. Mehta Y, Gupta A, Todi S, et al. Guidelines for prevention of hospital acquired infections. Indian J Crit Care Med. 2014;18(3):149–163.
17. Ordinul nr. 1101/2016 al MS privind aprobarea Normelor de supraveghere, prevenire și limitare a infecțiilor asociate asistenței medicale în unitățile sanitare. https://lege5.ro/Gratuit/geztanjsgmzq/ordinul-nr-1101-2016-privind-aprobarea-normelor-de-supraveghere-prevenire-si-limitare-a-infectiilor-asociate-asistentei-medicale-in-unitatile-sanitare.
18. Haque M, McKimm J, Godman B, et al. Initiatives to reduce postoperative surgical site infections of the head and neck cancer surgery with a special emphasis on developing countries. Expert Rev Anticancer Ther 2019; 19: 81–92.
19. European Union (2018), "Healthcare-associated infections", in Health at a Glance: Europe 2018: State of Health in the EU Cycle, OECD Publishing, Paris/European Union, Brussels. https://doi.org/10.1787/health_glance_eur-2018-45-en
20. Cunha TF, Soares Melancia TA, Zagalo Fernandes Ribeiro CM, et al. Risk factors for surgical site infection in cervico-facial oncological surgery. J Craniomaxillofac Surg 2012; 40: 443–448.
21. Lotfi CJ, Cavalcanti R de C, Costa e Silva AM, et al. Risk factors for surgical-site infections in head and neck cancer surgery. Otolaryngol Head Neck Surg 2008; 138: 74–80.
22. Penel N, Fournier C, Lefebvre D, Lefebve JL. Multivariate analysis of risk factors for wound infection in head and neck squamous cell carcinoma surgery with opening of mucosa. Study of 260 surgical procedures. Oral Oncol. 2005; 41(3):294–303.
23. Kamizono K, Sakuraba M, Nagamatsu S, et al. Statistical analysis of surgical site infection after head and neck reconstructive surgery. Ann Surg Oncol 2014; 21: 1700–1705.
24. Park, SY, Kim, MS, Eom, JS, Lee, JS, Rho, YS. Risk factors and etiology of surgical site infection after radical neck dissection in patients with head and neck cancer. Korean J Intern Med. 2016; 31:162-169.
25. Belusic-Gobic M, Car M, Juretic M, Cerovic R, Gobic D, Golubovic V. Risk factors for wound infection after oral cancer surgery. Oral Oncol. 2007; 43:77–81.
26. Lee DH, Kim SY, Nam SY, Choi SH, Choi JW, Roh JL. Risk factors of surgical site infection in patients undergoing major oncological surgery for head and neck cancer.Oral Oncol.2011; 47:528-531.
27. Schwartz SR, Yueh B, Maynard C, Daley J, Henderson W, Khuri SF. Predictors of wound complications after laryngectomy: A study of over 2000 patients.Otolaryngol Head Neck Surg., 2004; 131:61–68.
28. Klavs I, Bufon Lužnik T, Skerl M, et al. Prevalance of and risk factors for hospital-acquired infections in Slovenia-results of the first national survey, 2001. J Hosp Infect. 2003; 54(2):149–157.
29. Lizioli A, Privitera G, Alliata E, Antonietta Banfi EM, Boselli L, Panceri ML, Perna MC, Porretta AD, Santini MG, Carreri V.Prevalence of nosocomial infections in Italy: result from the Lombardy survey in 2000.J Hosp Infect. 2003; 54(2):141-148.
30. Astrinaki E, Roumbelaki M, Ioannidou E, Gikas A. Prevalence, incidence burden, and clinical impact of healthcare-associated infections and antimicrobial resistance: a national prevalent cohort study in acute care hospitals in Greece. Infect Drug Resist. 2017; 10:317-328.
31. Eriksen HM, Iversen BG, Aavitsland P. Prevalence of nosocomial infections in hospitals in Norway, 2002 and 2003. The French Prevalence Survey Study Group. J Hosp Infect. 2005;60(1):40–45
32. Nuvials X, Palomar M, Alvarez-Lerma F, et al. Health-care associated infections. Patient characteristics and influence on the clinical outcome of patients admitted to ICU. Envin-helics registry data. Intensive Care Med Exp. 2015; 3(Suppl 1):A82.
33. Bagshaw SM, Laupland KB. Epidemiology of intensive care unit-acquired urinary tract infections. Curr Opin Infect Dis. 2006; 19(1):67-71.
34. Tedja R., Wentink J. , O'Horo J., Thompson R., Sampathkumar P. Catheter-Associated Urinary Tract Infections in Intensive Care Unit Patients. Infection Control & Hospital Epidemiology 2015; 36(11):1330–1334.
35. Walter J. , Haller S. , Quinten C. , Kärki T. , Zacher B. , Eckmanns T. , Abu S. M. , Plachouras D. , Kinross P. , Suetens C. , ECDC PPS study group . Healthcare-associated pneumonia in acute care hospitals in European

Union/European Economic Area countries: an analysis of data from a point prevalence survey, 2011 to 2012. Euro Surveill. 2018; 23(32): pii=1700843. https://doi.org/10.2807/1560-7917.ES.2018.23.32.1700843

36. Metsini A, Vazquez M, Sommerstein R, Marschall J, Voide C, Troillet N, Gardiol C, Pittet D, Zingg W The Swissnoso Network. Point prevalence of healthcare-associated infections and antibiotic use in three large Swiss acute-care hospitals.Swiss Med Wkly. 2018 26; 148:w14617.
37. Rosenthal VD, Maki DG, Salomao R, Moreno CA, Mehta Y, Higuera F, Cuellar LE, Arikan OA, Abouqal R, Leblebicioglu H. Consortium International Nosocomial Infection Control. Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. Ann Intern Med. 2006; 14(8):582–591.
38. Page DB, Donnelly JP, Wang HE. Community-, Healthcare-, and Hospital-Acquired Severe Sepsis Hospitalizations in the University HealthSystem Consortium. Crit Care Med. 2015; 43(9):1945-1951.