ETIOLOGICAL STRUCTURE OF HEALTHCARE-ASSOCIATED INFECTIONS IN ST. MARINA UNIVERSITY HOSPITAL OF VARNA FOR THE PERIOD 2011-2015

[1]*Monov D.,*
[2]*Paunov Tz.,*
[3]*Mileva S.,*
[3]*Deneva D.,*
[4]*Zeleva E.*

Bulgaria, Varna;
[1]*Educational Scientific sector "Health inspector" Medical College - Varna Medical University Varna,*
[2]*Medical University of Varna, Department of " Hygiene and epidemiology",*
[3]*"St. Marina" University Hospital of Varna,*
[4]*Medical University of Varna, Sliven branch, Department of " Nursing care"*

ABSTRACT

Introduction. Etiology in medical context refers to the study of the causes of diseases (from greek: αίτία – „cause" and λόγος – „science"). In philosophy it refers to causality. Prognosis of healthcare-associated infections (HAIs) depends largely on the severity and microbiological investigations and monitoring of the patents.

Aim. To study the etiology of the HAIs and the percentage of uninvestigated and unproved cases in St. Marina University Hospital of Varna in the period 2011-2015.

Materials. data derived from medical documentation for microbiological investigations; reports and analysis from the microbiological laboratory of the hospital.

Methods. statistical, epidemiological analysis.

Results. Analysis of the etiologic structure of the HAIs for the period of investigation showed decrease of the uninvestigated cases from 3,44 % for 2014 to 0,46 % for 2015. Rising efficacy of the diagnostic methods was notable as well, demonstrated by a decrease in microbiologically unproved cases from 3 % for 2014 to 1,38 % for 2015.

Conclusion. After 2012 the leading cause of nosocomial infections was Acinetobacter baumanni, which caused *20,64 % of the infections in 2014 and* 18,81 % in 2015, respectively. Klebsiella pneumonie which was the leading agent in 2011 fell to second position causing 14,25 % of the infections in the same year. Further comes Pseudomonas aeruginosa (with up to 11,90 % in 2015) followed by *Staphylococcus aureus* (with 10,32 % in 2015). Isolation of the latter have increased twice in a year (it caused only 5,5 % of the HAIs in 2014).

Introduction. Etiology is a science that studies causes of the diseases (from greek: αίτία – „cause" and λόγος – „science"). In philosophy it refers to causality (1,2). Unlike any other laboratory investigation, microbiological investigation ends with etiologic diagnosis that is the most accurate and direct way to proper therapy. *The prognosis of the healthcare-associated infections (HAIs) depends largely on the severity and microbiological monitoring of the patents. The general condition of patients and especially co-morbidities are the factors that lead to certain therapeutic procedures. The fact that etiological agents causing infections depend on the premorbid patients' status must be kept in mind. In outpatient healthcare facilities "exported" nosocomial infections are often encountered*. They differ considerably from the typical outpatient infections in terms of microbial spectrum and its higher antimicrobial resistance. According to that, different therapeutic approach is required. Antibacterial therapy depends on the general condition of patients, presence of additional diseases, and especially the preceding antibacterial therapy (3).

The aim is to study the etiologic spectrum of HAIs in St. Marina University Hospital of Varna in the period 2011-2015 as well as the percentage of uninvestigated and unproved cases for the same period.

Materials. Data derived from medical documentation that refer to the microbiological investigations; reports and analysis from the microbiological laboratory of the hospital.

Methods. Statistical, epidemiological analysis.

Results. Etiologic structure of the nosocomial infections and the percentage of uninvestigated and unproved cases in St. Marina University Hospital of Varna for the years 2011 to 2015 are presented in the following figures (fig.1-4).
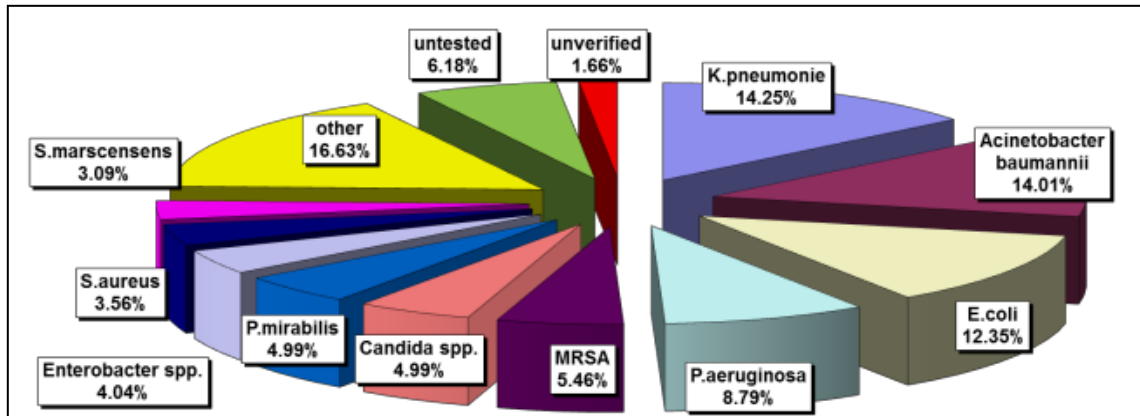

Fig. 1. Etiologic structure of nosocomial infections in St. Marina University Hospital of Varna for the year 2011

In 2011 (Fig. 1) the leading causes of nosocomial infections are: *Klebsiella pneumonie* – 14,25 %, *Acinetobacter baumannii* – 14.01 %, *Escherichia coli* – 12,35 % and *Pseudomonas aeruginosa* – 8,79 %. A decrease in the role of *K.pneumonie* in comparison to the year 2010 when it caused 20,81 % of the infections is notable. Other observation is the increase of *E.coli infections* (9,05 %). *(Bulletin 2010 St. Marina University Hospital of Varna)*.

Uninvestigated cases of nosocomial infections are 6,18 %, compared to 4,52 % in 2010. Microbiologically unproved are 1,66 % vs 3,62 % in 2010.
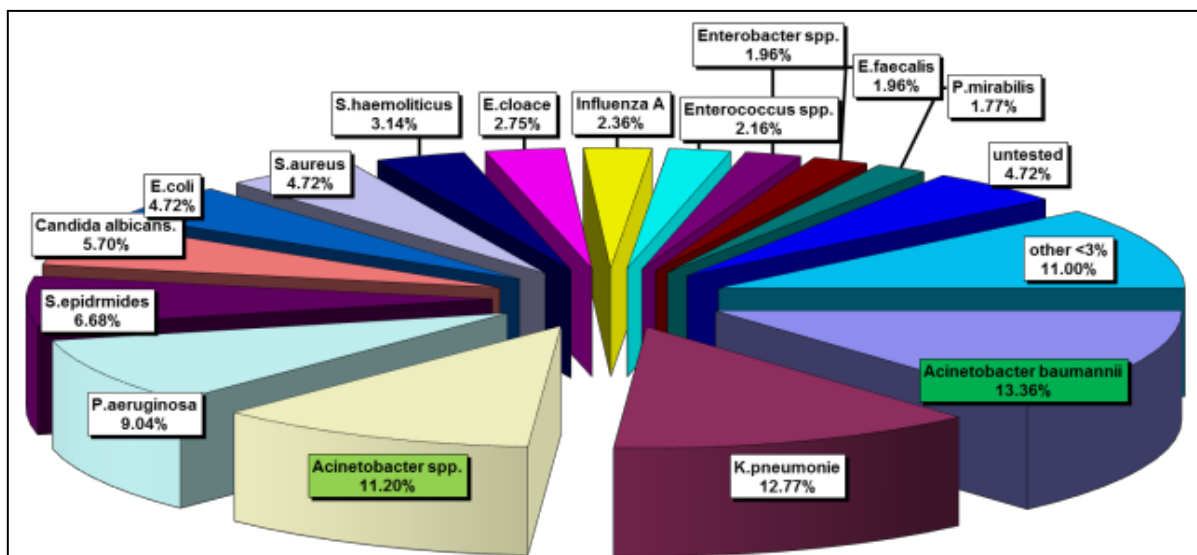

Fig. 2. Etiologic structure of nosocomial infections in St. Marina University Hospital of Varna for the year 2012

In 2012 (Fig. 2) the leading cause of nosocomial infections is *Acinetobacter baumannii* (13,36 %). *Acinetobacter spp* are responsible for 11,20 % of the infections and along with *Acinetobacter baumannii* they cause 25 % of the cases. They are followed by *Klebsiella pneumonie* (12,7 %), *Pseudomonas aeruginosa* (9,04 %) and *Staphylococcus.epidrmidis* (6,68 %), the last one frequently isolated from cardiac surgery patients. Escherichia coli – 12,35 % (2011) и – 8,79 % (2010). A decrease of E. coli caused infections (4,72 %) compared to 2011 was found.

Uninvestigated and unproved cases of nosocomial infections dropped from 8 % in 2011 to 4,72 % in 2012.
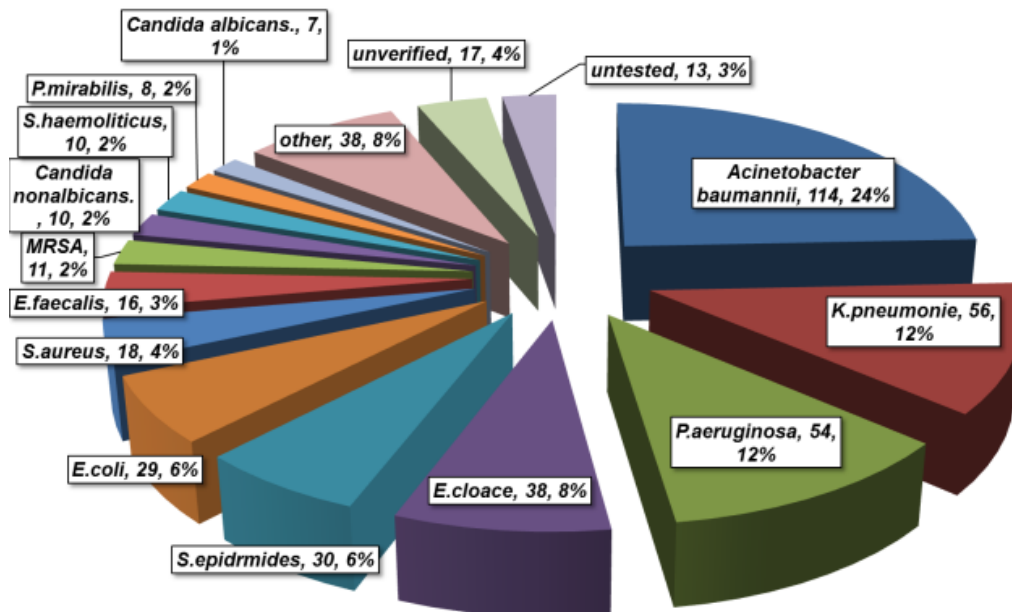
Fig. 3. Etiologic structure of nosocomial infections in St. Marina University Hospital of Varna for the year 2013
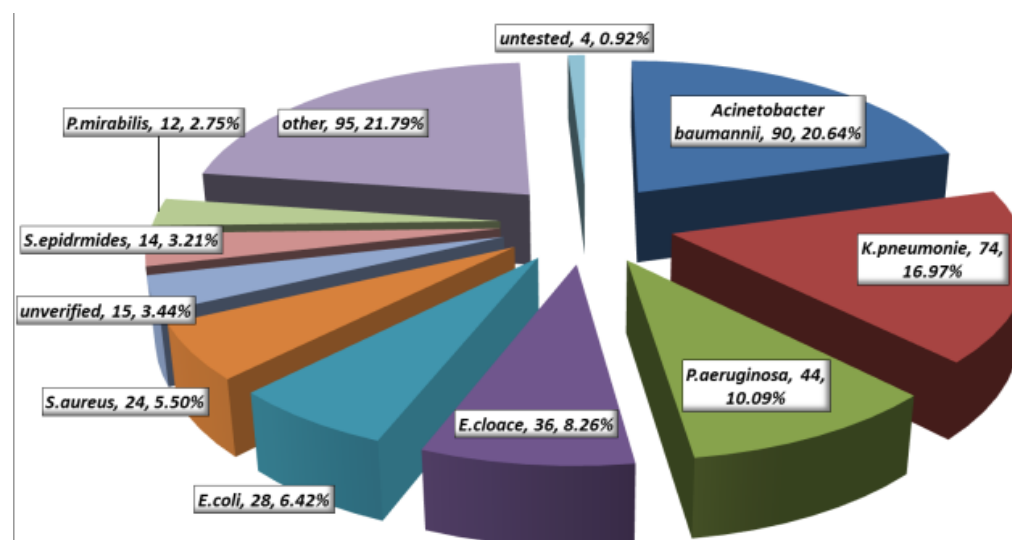

Fig. 4. Etiologic structure of nosocomial infections in St. Marina University Hospital of Varna for the year 2014

In 2014 *(Fig. 4.)* the most frequent bacterial agent was again *Acinetobacter baumannii* (20,64 %), followed by *Klebsiella pneumonie* (17 %), *Pseudomonas aeruginosa* (10 %), *E.cloacae* (8 %). The percentage of HAI cases due to *Staphylococcus epidermidis* dropped to 3 % of all. There is no significant differences in isolated nosocomial flora compared to 2013 – the most encountered agent is again *Acinetobacter baumannii* (24 %), followed again by *Klebsiella pneumonie* (12 %), *Pseudomonas aeruginosa* (12 %) and *Staphylococcus epidermidis* (6 %).(2013) Uninvestigated and microbiologically unproved are 3 %, compared to 4,72 % in 2013. (Fig.3)

Acinetobacter baumannii is still the leading nosocomial agent in 2015 (Fig. 5*)* (18,81 %) but there is a slight tendency for lowering of the cases due to it compared to previous years 20 % (2014) and 24 % (2013). *Klebsiella pneumonie* comes next as a nosocomial pathogene with 12.85 % showing also decreased frequency (17 % in 2014). Slight increase in the cases due to *Pseudomonas aeruginosa* are noted (11,90 %), compared to 10 % in 2014 and 12 % in 2013. In 2015г. *Staphylococcus aureus* nosocomial infections increased twice (10,32 %), compared to 5.5 % in 2014. Uninvestigated and microbiologically unproved infections were < 2 %, compared to 3,44 % in 2014. The rest of the nosocomial pathogenes are similarly distributed throughout the period.
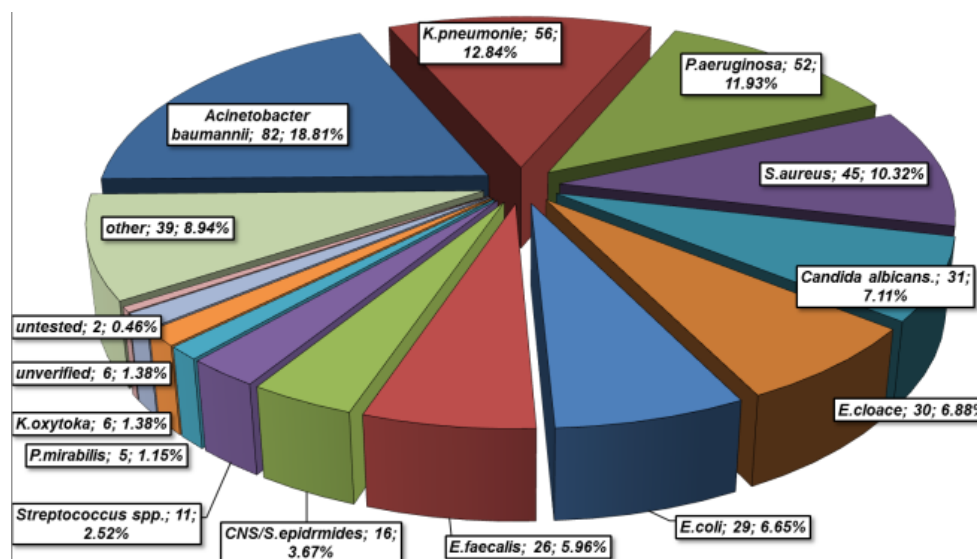
Fig. 5. Etiologic structure of nosocomial infections in St. Marina University Hospital of Varna for the year 2015

Discussion. Analysis of the etiologic structure of healthcare-associated infections (HAIs) in the hospital in the period 2011-2015 shows increasing identification of the etiologic agent, decrease of uninvestigated (from 3,44 % in 2014 to 0,46 % in 2015) and unproved cases (from 3 % in 2014 to 1,38 % in 2015). Enhanced effectiveness of microbiology laboratories as well as the systematic efforts of the HAIs surveillance unit had left to a great progress.

In 2009 I.Mitova and N.Ribarova published the results of a study about the dynamics, etiologic and clinical structure of the nosocomial infections in Bulgaria for the period 1982-2008. Forty nine percent of the registered nosocomial infections were etiologically proved, 18,83 % have left unidentified, uninvestigated – 32,13 %. For comparison, the percentage of the identified nosocomial infections in the 80's of the 20th century was 46,7 %, the unidentified – 23,82 % and the uninvestigated ones – 29,48 %.

The current study found 22 etiologic agents of HAIs for the period 2011-2015 with marked superiority of *Klebsiella pneumonie* – 14,25 % in 2011, 12,77 % in 2012, 12 % in 2013, 16,97 % in 2014 and 12,80 % in 2015. *Acinetobacter baumannii* was identified in 14.01 % of the cases in 2011, 13,36 % in 2012, 20,64 % in 2013 and 18,81 % in 2015. *Escherichia coli* was the isolated pathogene in 12,35 % in 2011, 4,72 % in 2012, 6,42 % in 2014 and 6,65 % in 2015. *Pseudomonas aeruginosa* was isolated in 8,79 % in 2011, 0,04 % in 2012, 12 % in 2013, 10,08 % in 2014 and 11,93 % in 2015 (Fig.4,5,6,7).

Ts. Paunov and al. (2005, 2006) published the results of a comparative study of the etiologic structure of HAIs in the same hospital and the Hospital of Dobrich. The researchers found that in 2003, 19 bacterial species were responsible for the HAIs in St.Marina hospital of Varna, while 16 were the species in the Hospital of Dobrich. In 2004 they were 17 and 22, and in 2005 – 23 and 31, respectively. Researchers also found differences between the two hospitals in terms of etiologic profile of the HAIs. Still, *P. aeruginosa*, *S. aureus*, *S. marcescens*, *A. baumanii*, *K. pneumoniae* were shared part of the leading ten bacterial causes of nosocomial infections in both hospitals.

An inpatient outbreak caused by *Klebsiella pneumoniae* ESBL took place in St. Marina University Hospital that began in the Pediatric Intensive Care Unit with further propagation to the Infectious department.(6,8) This episode is a reflection of *Klebsiella pneumoniae* capacity for aggressive distribution in the last decades. According to L.Mihaylova et al. (2012) the leading nosocomial agent in another university hospital – Dr Georgi Stranski hospital of Pleven is *E. coli* – 19.3 %, followed by *Staphylococcus aureus* and *S. epidermidis* - 23.2 % for both.

Systematic analysis of the circulating bacterial pathogenes in inpatient settings is one of the daily tasks of the commission for antibacterial therapy politics of the hospital, which purpose is to restrain antibacterial overuse, main cause of microbial resistance.

Conclusions. After 2012, the leading etiologic cause of nosocomial infections is *Acinetobacter baumanni*, that is responsible for

13,36 % of the infections in 2012, 24 % in 2013, 20,64 % in 2014 and 18,81 % in 2015.

In 2011 the most encountered pathogene was *Klebsiella pneumonie*, causing 14,25 % of the HAIs. In the next years the percentage of infections due to it slightly decreased -12,7 % in 2012, 12 % in 2013, 12.85 % in 2015. Only one deviation from that tendency was observed – *Klebsiella* caused 17 % of HAIs in 2014.

With some hesitations, the third place as a nosocomial pathogene was occupied by *Pseudomonas aeruginosa*, that started from the modest 8,79 % of the HAIs in 2011 but in the next years showed slight but constant increase as follows: 9,04 % in 2012; 12 % in 2013; 10 % in 2014; 11,90 % in 2015. However, *Staphylococcus aureus* was the pathogene showing most significant rise as percentage of the nosocomial infections due to it – from 5.5 % in 2014 to 10,32 % in 2015.

REFERENCES

1. https://bg.wikipedia.org/wiki/ %d0 %95 %d1 %82 %d0 %b8 %d0 %be %d0 %bb %d0 %be %d0 %b3 %d0 %b8 %d1 %8f

2. http://www.onlinerechnik.com/duma/ %d0 %b5 %d1 %82 %d0 %b8 %d0 %be %d0 %bb % d0 %be %d0 %b3 %d0 %b8 %d1 %8f

3. https://www.medinfo.bg/spisanie/2011/12/statii/bakterialni-prichiniteli-na-pnevmoniite-v-detska-vyzrast-1216

4. J. Mitova, N. Ribarova, Research on the Dynamics of the Etiological and Clinical Structure of Nosocomial Infections in Bulgaria in the Period 1982-2008. Nosocomial Infections, No. 1-2, 2009, 55-61

5. L. Mihaylova, S. Iliev, N. Maneva, T. Lukanov, I. Petkova, M. Marinova-Sunkova Supervision of Nosocomial Infections and Antimicrobial Therapy in High Risk Clinical Units in the University Hospital in Pleven: retrospective study for the period 2008 - 2010, Nosocomial infections, bp1-2,2012 83-89

6. L. Mihailova, S. Iliev, N. Gacheva. Frequency and Etiological Structure of Nosocomial Infections / Vbi in University Hospital "Dr. Georgi Stranski" - Pleven: Epidemiological Analysis for the Period 2003-2005 Nosocomial Infections, 1-2,2012., 101-109

7. C. Paunov, N. Vulkanova, D. Stoycheva, T. Panayotova, N. Alexandrova.. Comparative study of the species and etiological structure of nosocomial infections in UMHAT "St. Marina - Varna and the hospital - Dobrich. Nosocomial infections, nos. 2,2005, 41-44

8. C. Paunov, K. Bozhkova, M. Kyoseva.. ESBL-producing klebsiella pneumoniae-inducing bladder: results of the epidemiological study and microbiological studies. Nosocomial infections No. 2,2006,. 35-39