

## NURSE'S AWARENESS OF THE FORMS OF CATHETER-RELATED INFECTIONS AND THEIR PREVENTION MEASURES

### CONHECIMENTO DA ENFERMAGEM SOBRE AS FORMAS DE INFECÇÕES RELACIONADAS A CATETERES E SUAS MEDIDAS DE PREVENÇÃO

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**Ivaylo Ivanov\***

\*Faculty of Medicine, Trakia University, Stara Zagora, Bulgaria

Orcid: <https://orcid.org/0000-0001-6706-9553>

[ivaylo.m.ivanov.24@trakia-uni.bg](mailto:ivaylo.m.ivanov.24@trakia-uni.bg)

**Irinka Hristova\*\***

\*\*Faculty of Public Health and Healthcare, Department of Health Care, University of Ruse "Angel Kanchev", Ruse, Bulgaria

Orcid: <https://orcid.org/0000-0002-4859-2602>

[ihristova@uni-ruse.bg](mailto:ihristova@uni-ruse.bg)

**Greta Koleva\*\***

\*\*Faculty of Public Health and Healthcare, Department of Health Care, University of Ruse "Angel Kanchev", Ruse, Bulgaria

Orcid: <https://orcid.org/0000-0002-1270-5396>

[gkoleva@uni-ruse.bg](mailto:gkoleva@uni-ruse.bg)

**Despina Georgieva\*\***

\*\*Faculty of Public Health and Healthcare, Department of Health Care, University of Ruse "Angel Kanchev", Ruse, Bulgaria

Orcid: <https://orcid.org/0000-0001-7622-3145>

[dpgeorgieva@uni-ruse.bg](mailto:dpgeorgieva@uni-ruse.bg)

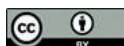
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#### Abstract

**Background:** It is known that most catheter-related infections are caused by medical infections. Much of the medical manipulation that a nurse deals with in any daily activity may involve the placement of catheters in the human body. The present work attempts to study the awareness of nurses working in intensive care units in the city of Ruse, Bulgaria, about catheter-related infections and preventive measures associated with them. **Material and Methods:** To find out how much the nurses working in the Intensive Care Unit (ICU) in Ruse, Bulgaria, are informed about the forms and measures for the prevention of catheter-related infections, we created a questionnaire containing 17 closed questions. A total of 68 questionnaires were sent to the two hospitals, corresponding to the number of working nurses at the ICU. **Conclusion:** The effect of "unused knowledge" is observed in some of the respondents. They know the rules that work, but it is impossible to follow them in practice.

#### Resumo

**Contexto:** Sabe-se que a maioria das infecções relacionadas a cateteres são causadas por infecções médicas. Grande parte da manipulação médica que um enfermeiro realiza em sua atividade diária pode envolver a inserção de cateteres no corpo humano. O presente trabalho busca estudar o conhecimento de enfermeiros que atuam em unidades de terapia intensiva na cidade de Ruse, Bulgária, sobre infecções relacionadas a cateteres e medidas preventivas associadas a elas. **Material e Métodos:** Para verificar o nível de conhecimento dos enfermeiros que trabalham na Unidade de Terapia Intensiva (UTI) em Ruse, Bulgária, sobre as formas e medidas de prevenção de infecções relacionadas a cateteres, elaboramos um questionário com 17 perguntas fechadas. Um total de 68 questionários foram enviados aos dois hospitais, correspondendo ao número de enfermeiros atuantes na UTI. **Conclusão:** Observou-se o efeito do "conhecimento não utilizado" em alguns dos respondentes. Eles conhecem as



**Keywords:** Catheter-Related Infection. Nurse. Nursing Practice. Preventive Measures.

*regras que funcionam, mas não conseguem segui-las na prática.*

**Palavras-chave:** Infecção Relacionada a Cateter. Enfermeiro. Prática de Enfermagem. Medidas Preventivas.

## 1 EXPOSITION

It is an indisputable fact that healthcare associated infections, also known as nosocomial or intra-hospital infections (IHI), are a serious medical and economic problem that continues to compromise hospital health in the 21st century even in developed countries. Current data for Europe show that the proportion of patients with infection in intensive care units reaches and exceeds 50%, and these are mainly IHI (Aloush, S. M., 2017; Salgado Yopez, E. *et al*, 2017).

At this stage in the development of medicine, scientific evidence has already been accumulated that shows that a large proportion of infections acquired during treatment can be prevented by implementing effective strategies. The pioneering project in this regard, Study on the Efficacy of Nosocomial Infection Control, SENIC Project (SENIC) was conducted in 1970-1976 and covered 339,000 patients in 338 randomly selected hospitals in the United States, in order to assess the effectiveness of the hospital control programs newly introduced in the 1960s. The results show that about 32% of IHI are preventable if successful prevention strategies are practiced. This, as well as all subsequent studies on the economic aspects of the problem, confirm the fact that only effective programs for supervision and control of IHI can reduce costs and manage the shortage of funds in hospitals (Haley, R. W. *et al*, 1985; Haley, R. W., 1980).

The central venous catheter /CVC/ is a device used to monitor hemodynamic parameters, administer intravenous drugs, fluids, blood products, and parenteral nutrition (Lai, N. M. *et al.*, 2016). Catheter-related bloodstream infection /CR-BSI/ is the third most common health-related infection /HAI/ in the intensive care unit, an important problem for infection prevention and control professionals. CR-BSIs lead to significant increase in morbidity, mortality, length of hospital stay and financial costs and should

therefore be considered as a failure in patient care. Reducing CR-BSI rates depends on following best practices to prevent infections (Blake, M., 2008).

Unlike other nosocomial infections, most risk factors for CR-BSI are device-related and can be prevented effectively. Continuous quality improvement programs are effective in reducing them. Key elements for the prevention of catheter-related bloodstream infection (CR-BSI) are hand hygiene, avoidance of unnecessary catheters, complete precautions for a sterile placement barrier, skin antiseptics with 2% chlorhexidine alcohol, use of chlorhexidine-impregnated dressings, immediate replacement of wet or detached catheter dressings and removal of catheters as soon as possible. Audit and feedback on the care process, infection rates and periodic training of healthcare providers are other tools to prevent CR-BSI (Buetti, N., Timsit, J. F., 2019).

In hemodialysis patients, CVC-associated bloodstream infections are a major cause of morbidity and mortality. During the COVID-19 pandemic, when hygienic precautions to prevent transmission were significantly enhanced, their effect on the rate of CVC-related infections was assessed. There has been a significant reduction (91%) in CR-BSI compared to the same period in 2019, suggesting that stricter application of hygiene precautions by nurses could significantly improve the problem of CVC-related infections (Heidempergher, M. *et al.*, 2021).

When the urinary catheter is not inserted with proper technique, it becomes dirty or stays for too long, microorganisms can travel through the lumen of the catheter or on the outside of the catheter and infect the bladder or kidneys, leading to catheter-related urinary tract infection. Urinary tract infections as a result of catheter use are one of the most common healthcare associated infections. Improving the practice of inserting and removing urinary catheters requires training and continuing education of nurses and physicians. Didactic tests and problem solving tasks are valuable methods for testing and evaluation of basic learning (Miteva, K., 2014). Healthcare professionals should be aware of the risks of bladder catheterization and take steps to prevent urinary tract infections as a result of catheter use (Clayton, J. L., 2017).

The global aging trend will also lead to an increase in the number of geriatric patients hospitalized at the ICU. To minimize the occurrence of CR-BSI in these patients, specific knowledge about them will need to be incorporated into the practice of health professionals in the intensive care unit, including the development of a vascular access

plan that includes choosing the right device and placement of this device, together with an evidence-based care and maintenance program (Chernecky, C., *et al.*, 2015).

Modern healthcare uses many types of invasive devices (consumables) and procedures for the treatment of patients, as well as in the process of their recovery. A number of healthcare associated infections may be related to "devices" used in invasive medical procedures such as catheters, mechanical pulmonary ventilation devices, and more. Such infections are: sepsis associated with a central or peripheral venous catheter; catheter-associated urinary tract infection; ventilation-associated pneumonia; infection at the surgical site. In other words, infections acquired in a hospital setting can affect a number of organs and systems, but the most common are urinary tract infections, respiratory tract infections, wound infections after surgery, and circulatory infections associated with vascular catheterization. This justifies the need to understand whether nurses working in intensive care units (as patients who are accommodated there are most often subjected to such medical procedures) are informed and familiar with catheter-related infections and measures to prevent them.

At the present stage we have approaches and measures for prevention and control of infections in hospital practice, which are based on proven scientific facts in the field of medicine, and the high level of modern technology provides increasingly effective ways to apply them. At the same time, observations and analyzes of purposefully collected information show that in their daily practice, medical staff constantly admits lapses - does not exactly follow the rules and guidelines that they know have been shown to reduce the risk of infection in patient care (asepsis and antiseptics), especially high in invasive treatment and diagnostic procedures. This finding is evidenced by numerous studies in the United States and Europe on the topic of nosocomial infections (Dumont, C.; Nesselrodt, D., 2012; Horan, T. C., *et al.*, 2008; Smith, C. V., 2015; Suwannakeeree, W.; Jullmusi, O., 2021; Whalen, A. M.; Mack, E. H., 2020; Zimlichman, E. *et al.*, 2013).

## **2 MATERIAL AND METHODS**

To find out how much the nurses working in the ICU in Ruse, Bulgaria, are informed about the forms and measures for the prevention of catheter-related infections,

we created a questionnaire containing 17 closed questions. Participation in the survey was voluntary and completely anonymous.

A total of 68 questionnaires were sent to the two university hospitals in the city of Ruse, corresponding to the number of working nurses at the ICU. 47 questionnaires were returned, fully completed, two partially completed and 19 not completed. 22 nurses from ICU in University Hospital for Active Treatment (UHAT) "Kanev", Ruse, Bulgaria and 25 nurses from ICU in UHAT "Medica Ruse", Bulgaria took part in the survey. The participating nurses from UHAT "Kanev" represent 68.7% of all nurses from this ward, and from UHAT "Medica Ruse" - 69.4% of all employees in ICU.

### 3 RESULTS

The age amplitude of the nurses working in ICU in the medical establishments on the territory of the city of Ruse, Bulgaria, is very polarizing - mostly or very young medical specialists work (just graduated), or the nurses are elderly. This only confirms that the average age of nurses in the country is high and will soon have a direct impact on the health care provided to patients in the country - on the one hand there is the question of how familiar the "elderly" nurses are with the innovations in the nursing profession, and on the other hand - how long they will be able to perform their official duties. The least in number on this indicator are the nurses from the age limit - 40-49 years (Table 1).

**Table 1**

*Age distribution of the respondents*

		Frequency	%	Valid %	Cumulative %
Valid	20-29	14	29,8	29,8	29,8
	30-39	8	17,0	17,0	46,8
	40-49	6	12,8	12,8	59,6
	50+	19	40,4	40,4	100,0
	Total	47	100,0	100,0	

It was no surprise to the study team that 95.74% (45n) of all nurses surveyed (47n) answered the main question - Are you familiar with the rules of asepsis and antiseptics when placing a peripheral venous catheter, central venous catheter and urethral catheter? answer Yes and only two (2n) nurses give an answer I am partly familiar with the rules

of asepsis and antiseptics. However, all respondents stated that they followed the rules of asepsis and antiseptics when placing a peripheral venous catheter, a central venous catheter and a urethral catheter.

The standards of good nursing practice in many developed countries and the strategies for dealing with intra-hospital infections in US hospitals clearly and unambiguously stipulate that when a catheter-associated infection is detected in a patient, the catheter (the foreign body) is removed immediately and take the necessary medical measures to deal with the infection (Patel, P. K. *et al.*, 2018). This gave us a reason to include in the questionnaire the control question - In the presence of phlebitis and permeable peripheral venous catheter in the immediate proximity, is it necessary to remove the peripheral venous catheter? - the results can be presented in Table 2.

**Table 2**

*In the presence of phlebitis and permeable peripheral venous catheter in the immediate proximity, is it necessary to remove the peripheral venous catheter?*

		Frequency	%	Valid %	Cumulative %
Valid	Yes	36	76,6	76,6	76,6
	I judge individually in each case	11	23,4	23,4	100,0
	Total	47	100,0	100,0	

Here we see that 23.4% (11n) of the respondents individually decide in each specific case of inflammatory disease of the venous wall in the immediate proximity of a peripheral venous catheter, whether to remove the venous cannula. These responses are puzzling, as these 23.4% of nurses are confident that they know what to do in a patient with a catheter-associated infection, and at the same time, in the presence of phlebitis, they judge on a case-by-case basis.

Another unacceptable answer for a working nurse is that she only occasionally observes patients with catheterized bladder for local inflammatory processes and secretion. Such an answer was given by 21.28% (10n) of the surveyed nurses (Table 3). To the delight of the whole public, none of the surveyed nurses gave a negative answer, i.e. most of them do their duty and constantly monitor catheterized patients, monitoring for local inflammation and spontaneous discharge in catheterized bladders.

**Table 3***Nurse monitoring of patients with catheterized bladder*

		Frequency	%	Valid %	Cumulative %
Valid	Yes	37	78,7	78,7	78,7
	Some-times	10	21,3	21,3	100,0
	Total	47	100,0	100,0	

From the answers given through the survey we report that in both intensive care units of the studied medical institutions, nurses keep records of the placement of a peripheral venous source and re-catheterization of catheterized patients on the bladder. Nurses know that catheter-related infections are often the cause of unclear febrile conditions and that genital hygiene is performed before catheterization of the bladder. They believe that their quality of work is directly related to the number of catheter-related infections.

#### **4 DISCUSSION**

The polarization in the age composition of nurses in intensive care units in Ruse confirms the trend for a high average age of medical specialists both in Bulgaria and around the world (Chen, W., Ma, Y., & Yu, C., 2023). This is an unfavorable trend for our country, regarding nurses. The lack of a sufficient number of nurses in the 40–49 age group is worrying. They should be the main age group of working nurses - they received their knowledge from schools, but also gained enough practical experience in the course of the work process.

Despite the high level of reported familiarity with the rules of asepsis and antisepsis, the contradictory responses regarding catheter removal in phlebitis call into question the actual understanding of the rules. In this sense, the question naturally arises - How can you not know the rules for something, and at the same time follow them? The answer to this question is very logical. Sometimes survey respondents try to disguise reality by giving a socially desirable answer to a question. The reasons for this may be different, but they are not the subject of this study..

The fact that over 20% of respondents only see patients with urethral catheters intermittently is concerning, as this increases the risk of infections. However, the lack of

negative responses to this question may be due to respondents' desire to present themselves in a positive light.

Good practices in documentation and awareness of the link between quality of care and catheter-associated infections are positive aspects, but further training and standardization of procedures are needed, especially for young and older nurses (Badparva, B., Ghanbari, A., Karkhah, S., *et al*, 2023). Our study highlights the need for measures to retain experienced staff and improve continuous training in the sector.

## 5 CONCLUSION

After a thorough analysis of the survey, the relative awareness of the nurses working in intensive care units in the city of Ruse can be confirmed about the forms of catheter-related infections and measures to prevent them. The effect of "unused knowledge" is observed in some of the respondents. They know the rules that work, but it is impossible to follow them in practice. This, on the one hand, may be due to the excessive involvement of medical professionals, and on the other - to the neglect of problems related to the quality and safety of medical care. Catheter-related infections are still a significant problem, both for our country and for the whole world.

The lack of written standards for good nursing practice - ordinances issued by the Minister of Health, leaves the issues related to catheter-related infections to the subjective judgment of medical professionals. As the survey showed, the nurses often decide for themselves, according to the specific case, how to react and whether to react at all in the presence of a patient with a catheter-associated infection.

It can be reasonably assumed that a large part of the nurses are informed about the issues under study. However, there are about 20% of them who give contradictory answers to the control questions, which speaks either of ignorance or unwillingness to answer the question unequivocally.

As a preventative measure to limit and reduce intra-hospital infections (many of which are catheter-related infections), the study team recommended working nurses who participated in the survey, as well as all others who are directly involved in catheter placement. (and all invasive medical manipulations), participation in refresher courses and seminars on topics - Asepsis and antiseptics; Catheter-related infections; Infections

related to medical care and ways to prevent them, etc. These are periodically organized both by the Bulgarian Association of Healthcare Professionals and by the University of Ruse "Angel Kanchev".

## REFERENCES

- ALLOUSH, S. M. Does educating nurses with ventilator-associated pneumonia prevention guidelines improve their compliance? *American Journal of Infection Control*, New York, v. 45, n. 9, p. 969-973, 2017. DOI: <https://doi.org/10.1016/j.ajic.2017.04.009>
- SALGADO YEPEZ, E. *et al.* Device-associated infection rates, mortality, length of stay and bacterial resistance in intensive care units in Ecuador: International Nosocomial Infection Control Consortium's findings. *World Journal of Biological Chemistry*, v. 8, n. 1, p. 95-101, 2017. DOI: <https://doi.org/10.4331/wjbc.v8.i1.95>
- HALEY, R. W. *et al.* The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *American Journal of Epidemiology*, v. 121, n. 2, p. 182-205, 1985. DOI: <https://doi.org/10.1093/oxfordjournals.aje.a113990>
- HALEY, R. W.; QUADE, D.; FREEMAN, H. E.; BENNETT, J. V. The SENIC Project. Study on the efficacy of nosocomial infection control (SENIC Project). Summary of study design. *American Journal of Epidemiology*, v. 111, n. 5, p. 472-85, 1980. DOI: <https://doi.org/10.1093/oxfordjournals.aje.a112928>
- LAI, N. M. *et al.* Skin antisepsis for reducing central venous catheter-related infections. *Cochrane Database of Systematic Reviews*, n. 7, p. CD010140, 2016. DOI: <https://doi.org/10.1002/14651858.CD010140.pub2>
- BLAKE, M. Update: Catheter-related bloodstream infection rates in relation to clinical practice and needleless device type. *Canadian Journal of Infection Control*, v. 23, n. 3, p. 156-60, 162, 2008.
- BUETTI, N.; TIMSIT, J. F. Management and Prevention of Central Venous Catheter-Related Infections in the ICU. *Seminars in Respiratory and Critical Care Medicine*, v. 40, n. 4, p. 508-523, 2019. DOI: <https://doi.org/10.1055/s-0039-1693705>
- HEIDEMPERGHER, M. *et al.* Targeting COVID-19 prevention in hemodialysis facilities is associated with a drastic reduction in central venous catheter-related infections. *Journal of Nephrology*, v. 34, n. 2, p. 345-353, 2021. DOI: <https://doi.org/10.1007/s40620-020-00900-3>
- MITEVA, K. Testing and evaluation in the practical training of the students in the specialty of midwife. 9th International Balkan Congress of Education and Science October October 2014 Thracian University - Edirne, Turkey, 2014. p. 329-332.

Available from: <https://eprints.ugd.edu.mk/12007/7/7.pdf>. Access on: 18 Nov 2024.

- CLAYTON, J. L. Indwelling Urinary Catheters: A Pathway to Health Care-Associated Infections. *AORN Journal*, v. 105, n. 5, p. 446-452, 2017. DOI: <https://doi.org/10.1016/j.aorn.2017.02.013>
- CHERNECKY, C.; MACLIN, D.; BLACKBURN, P. Catheter-Related Bloodstream Infections (CR-BSI) in Geriatric Patients in Intensive Care Units. *Critical Care Nursing Quarterly*, v. 38, n. 3, p. 280-292, 2015. DOI: <https://doi.org/10.1097/CNQ.0000000000000076>
- DUMONT, C.; NESSELRODT, D. Preventing central line-associated bloodstream infections CLABSI. *Nursing*, v. 42, n. 6, p. 41-6; quiz 47, Jun. 2012. DOI: <https://doi.org/10.1097/01.NURSE.0000414623.31647.f5>
- HORAN, T. C.; ANDRUS, M.; DUDECK, M. A. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *American Journal of Infection Control*, v. 36, n. 5, p. 309-332, 2008. DOI: <https://doi.org/10.1016/j.ajic.2008.03.002>
- SMITH, C. V. On the road to zero CAUTIs: Reducing urinary catheter device days. *American Nurse Today*, v. 10, n. 1, p. 46-48, 2015.
- SUWANNAKEEREE, W.; JULLMUSI, O. Prevention of Central Line-Associated Bloodstream Infection. *Journal of Nursing and Health Sciences*, v. 15, n. 2, p. 1-13, 2021. Available from: <https://he01.tci-thaijo.org/index.php/NurseNu/article/view/249830>. Access on: 16 Nov 2024.
- WHALEN, A. M.; MACK, E. H. Prevention of Central Line-Associated Bloodstream Infections in Children: Current Challenges and Opportunities. *Current Treatment Options in Pediatrics*, p. 1-11, 2020.
- ZIMLICHMAN, E. *et al.* Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. *JAMA Internal Medicine*, v. 173, n. 22, p. 2039-46, 2013. DOI: <https://doi.org/10.1001/jamainternmed.2013.9763>
- PATEL, P. K. *et al.* Review of Strategies to Reduce Central Line-Associated Bloodstream Infection (CLABSI) and Catheter-Associated Urinary Tract Infection (CAUTI) in Adult ICUs. *Journal of Hospital Medicine*, v. 13, n. 2, p. 105-116, 2018. DOI: <https://doi.org/10.12788/jhm.2856>
- CHEN, W.; MA, Y.; YU, C. Unmet chronic care needs and insufficient nurse staffing to achieve universal health coverage in China: Analysis of the Global Burden of Disease Study 2019. *International Journal of Nursing Studies*, v. 144, p. 104520, 2023. DOI: <https://doi.org/10.1016/j.ijnurstu.2023.104520>
- BADPARVA, B. *et al.* Prevention of central line-associated bloodstream infections:

ICU nurses' knowledge and barriers. *Nursing in Critical Care*, v. 28, n. 3, p. 419-426, 2023. DOI: <https://doi.org/10.1111/nicc.12757>

### **Authors' Contribution**

All authors contributed equally to the development of this article.

### **Data availability**

All datasets relevant to this study's findings are fully available within the article.

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