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# IMPACT OF BUNDLES ON THE PREVENTION OF URINARY TRACT INFECTION ASSOCIATED WITH THE VESICAL CATHETER: SYSTEMATIC REVIEW

# IMPACTO DE BUNDLES NA PREVENÇÃO DA INFEÇÃO DO TRATO URINÁRIO ASSOCIADA AO CATETER VESICAL: REVISÃO SISTEMÁTICA

# IMPACTO DE PAQUETES EN LA PREVENCIÓN DE INFECCIÓN DEL TRACTO URINARIO ASOCIADA CON EL CATÉTER VESICAL: REVISIÓN SISTEMÁTICA

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# ABSTRACT

Urinary tract infection is one of the most frequent infections in intensive care units, affecting the quality of life and safety of patients, its prevention is imperative. The bundle is constituted as a group of interventions, which applied together, obtain results in the prevention of a certain nosocomial infection.

We aimed to analyze the impact of bundle use in reducing urinary tract infections associated with the bladder catheter; identify interventions that may integrate the bladder catheter insertion and maintenance bundle.

In this systematic review, we searched databases (B-On and PubMed) and online libraries, using as search terms: catheter-associated urinary tract infection and care bundle. Two hundred sixty one studies were obtained, after selection and analysis, including 7 studies. All studies aimed to determine the impact of bundle application in reducing the incidence rate of bladder catheter-associated urinary tract infection. In all studies, a reduction was observed after bundle application.

The application of insertion and maintenance bundle of the bladder catheter has evidence in decreasing the incidence rate of catheter-associated urinary tract infection in adult patients admitted to intensive care units.


**Keywords:** Catheter-Related Infections; Critical Care; Patient Care Bundles; Systematic Review Urinary Tract Infections.


# RESUMO

A Infeção do trato urinário é uma das infeções mais frequentes em unidades de cuidados intensivos, afetando a qualidade de vida e a segurança dos utentes, a sua prevenção é imperativa. A *bundle* constitui-se como um grupo de intervenções, que aplicadas em conjunto, obtém resultados na prevenção de determinada infeção hospitalar.

O objetivo foi analisar o impacto da utilização de *bundle*, na redução das infeções do trato urinário associadas ao cateter vesical; identificar as intervenções que podem integrar a *bundle* de inserção e manutenção do cateter vesical.

Nesta revisão sistemática, realizou-se pesquisa em bases de dados (B-On e PubMed) e utilizando como termos de pesquisa: "*catheter-associated urinary tract infection*" e "*care bundle*". Obtiveram-se 261 estudos, após seleção e análise, incluíram-se 7 estudos.

Todos os estudos tinham como objetivo determinar o impacto da aplicação de *bundle* na redução da taxa de incidência de infeção do trato urinário associada ao cateter vesical. Em todos os estudos observa-se redução da mesma, após a aplicação de *bundle*.

A aplicação de *bundle* de inserção e de manutenção do cateter vesical, tem evidência na diminuição da taxa de incidência de infeção do trato urinário associada ao cateter vesical em doentes adultos internados em unidades de cuidados intensivos.
**Palavras-chave:** Cuidados Críticos; Infecções Relacionadas a Cateter; Infecções Urinárias; Pacotes de Assistência ao Paciente; Revisão Sistemática.

# RESUMEN

La infección del tracto urinario es una de las infecciones más frecuentes en las unidades de cuidados intensivos, afecta la calidad de vida y la seguridad de los pacientes, su prevención es imprescindible. El paquete se constituye como un grupo de intervenciones que, aplicadas juntas, obtienen resultados en la prevención de una determinada infección nosocomial.

Objetivo analizar el impacto del uso de paquetes en la reducción de infecciones del tracto urinario asociadas con el catéter vesical; Identificar intervenciones que puedan integrar la inserción del catéter vesical y el paquete de mantenimiento.

En esta revisión sistemática, buscamos bases de datos (B-On y PubMed) y bibliotecas en línea, utilizando como términos de búsqueda: infección del tracto urinario asociada al catéter y paquete de atención. Se obtuvieron 261 estudios, después de la selección y el análisis, incluidos 7 estudios.

Todos los estudios tuvieron como objetivo determinar el impacto de la aplicación de paquetes en la reducción de la tasa de incidencia de infección urinaria asociada al catéter vesical. En todos los estúdios, se observó una reducción después de la aplicación del paquete.

La aplicación del paquete de inserción y mantenimiento del catéter vesical tiene evidencia para disminuir la tasa de incidencia de infección urinaria asociada al catéter vesical en pacientes adultos ingresados en unidades de cuidados intensivos.
**Descriptores:** Cuidados Críticos; Infecciones Relacionadas con Catéteres; Infecciones Urinarias; Paquetes de Atención al Paciente; Revisión Sistemática.

# INTRODUCTION

Infections associated with healthcare (IAHC) and the increased resistance to antimicrobials are increasingly important problems that require effective action by healthcare providers. These two problems are interconnected and are interdependent, becoming a growing threat to the health of populations, so the prevention of IAHCs is essential[1].

Of all IAHCs, the urinary tract is one of the most relevant, and it has been the infection that is most associated with healthcare in Europe[2]. The urinary tract infection associated with the bladder catheter (UTIABC) represents about 40% of IAHCs[3] and is the second cause of IAHCs with a mortality rate around 15% to 25%[4]. Also in Portugal, it was the most frequent in health units of the National Integrated Continuing Care Network in 2017, corresponding to 34.48% of all types of infections[1].

The use of bladder catheters is unmistakably associated with an increased risk of urinary tract infections (UTI)[5]. Approximately 80% of UTIs are related to the use of the bladder catheter and its duration. The presence of the catheter increases the risk of acquiring infection by 5% for each day of use, which leads to an estimate of 100% after 28 days. Approximately 4% of patients may progress to secondary infection with an estimated mortality rate of 30%[3].

About 15% to 25% of patients hospitalized are submitted to the placement of a bladder catheter, and 43.9% to 54% are improperly cuffed. The clean intermittent catherisation should be used as a last resort and, as soon as possible, the bladder catheter should be removed[5]. The frequency with which patients are catheterized and the catheterization time determines the greater or lesser risk of UTI.

The need to implement approaches to prevent this type of infection then becomes evident. It is in this course that the "bundle" appears, and consists of a set of interventions (usually between three and five), based on the best evidence, which when applied correctly and integrated, improve safety and results with the patient[6].

In order to reduce the high rates of UTIABC, it is necessary to identify gaps not only in the prescription, but also in the maintenance of these devices and in this context it is important to emphasize the importance that the nurse has in the insertion, reinsertion, maintenance and removal of the bladder catheter. Thus, the degree of knowledge, collaborative capacity and autonomy of nurses are essential in the prevention of UTIABC. In this sense, the investment in updating the scientific knowledge of nurses, the creation of clear and objective guidelines, which accurately define the criteria for placement, reinsertion and removal, may have a very significant impact on the reduction of UTIABC[7].

According to what has been explained, UTI's are a serious problem and their prevention is urgent. However, there is still little data in the literature that allows us to know the reality of preventing UTI.

Taking into account the relevance of the application of bundles in the provision of care, especially with regard to the prevention of IAHCs, based on the most recent scientific evidence, we define the objectives of this systematic review: to analyze the impact of the use of bundles, in reducing urinary tract infections associated with the bladder catheter; to identify interventions that can integrate the bladder catheter insertion and maintenance bundle.

# METHODOLOGY

In this review it is used the methodology recommended by the Joanna Briggs Institute (JBI)[8]. In response to the first stage of this methodology, we present the research question traced through the strategy PICOS, Population, Intervention, Control, Outcomes, Study design: "In the critical adult patient, with a bladder catheter (P), the bundle (I) decreases urinary tract infections associated with the bladder catheter (O)?".

As the research question was formulated, and guided by the JBI methodology, we defined the inclusion criteria for the researched studies: type of participants – patients over the age of 18, admitted to intensive care units (ICU); type of intervention – studies using bundles; types of results – studies that present the impacts of bundling on the incidence of UTIABC; type of studies – primary, quantitative studies, published in English from 2014 to 2019. Exclusion criteria for the studies surveyed were also defined: type of participants – patients under the age of 18 and/or hospitalized in units, who did not intensive care; types of results – studies that analyze the impact of the bundle on the incidence rate of various infections associated with health care, are excluded, unless they present separate and properly identified results for UTIABC; type of studies – secondary, qualitative studies, published in a language other than English, with publication date before 2014.

### *Research strategy*

The survey was conducted on October 25, 2019. With regard to research sources, the databases used during the research process were PubMed (National Library of Medicine) and B-On (Online Knowledge Library). The following were used as limiters: date of publication in the last 5 years (2014-2019); with full-text available; analyzed by experts; and that the subject contained the terms "catheter-associated urinary tract infections" "care bundle".

The keywords used were: "catheter-associated urinary tract infections"; Care bundle, by using the Boolean operator "AND".

The study selection process can be consulted in the PRISMA Flow Diagram (Fig.1↗)[9].

When executing this article, all ethical and legal issues were considered, as well as the principles defended by the Declaration of Helsinki. In order to respect the work done by the authors, all the documents used were duly referenced and cited, thus ensuring the required academic integrity.

*Methodological quality assessment*

After the selection process was carried out, 7 articles were evaluated by two reviewers for their methodological quality, before inclusion in the review, using the JBI standardized critical assessment instrument – checklist[10-11] for quasi-experimental and cohort studies (Table 1↗). There was no disagreement between the reviewers regarding the inclusion or critical evaluation of the results.

*Data extraction*

The data were extracted, by the two reviewers, using JBI data extraction instruments[8]. The data extracted from each article were summarized in a table↗, with presentation of the title, objective, sample characteristics, results and conclusions.

# DISCUSSION

The studies included in this systematic literature review took place between 2015 and 2019, carefully presenting its objectives, the method of data collection and its sample.

Through the analysis of the articles included in this review, it was possible to understand that the objective is common, to assess the impact of bundle on the incidence of UTIABC, in the critical adult patient hospitalized in the ICU.

About the articles analyzed, three studied the impact of bundles in a single ICU (A1, A4 and A5). Studies A3 and A6 analyzed the largest number of ICUs, eighteen and thirteen, respectively. In A7, five ICUs were studied, and A2 analyzed two units.

The studies analyzed were all carried out in Asian countries. Two of the articles (A3 and A4) were developed in India, one in China (A5), another in Taiwan (A6) and the rest in Saudi Arabia (A7), Turkey (A1) and Iran (A2).

As for the bundle used in the studies, it included between 3 and 7 interventions. The bundle applied in the studies differs in terms of the interventions that constitute it. On the studies included, six present the interventions that make up the bundle. Only the A2 study does not present carefully the interventions used and states that it was based on the guidelines of the Centers of Disease Control and Prevention, United States of America (USA).

On the studies analyzed, three of them (A5, A6 and A7) have a bladder catheter insertion bundle and a bladder catheter maintenance bundle. The remaining three (A1, A3 and A4) have only maintenance bundles.

Among the interventions that were part of the bundle, the most used in the bladder catheter insertion bundle were: hand washing and placement of personal protective equipment (PPE's) (A5, A6 and A7); hygiene of the perineum and disinfection of the meatus (A5, A6 and A7); use of aseptic technique during insertion (A5, A6 and A7). Regarding the bladder catheter maintenance bundle, the most common interventions were: daily assessment of the need to maintain bladder catheterization (A1, A3, A4, A5, A6 and A7); keeping the urine collection bag below the level of the bladder (A1, A4, A5, A6 and A7); ensuring the maintenance of a closed system (A1, A3, A5, A6 and A7); emptying the collector bag as soon as it is 2/3 of the total (A3, A5, A6 and A7).

Two articles (A1 and A6) specified which bundle interventions had the least adherence by nurses. In article A1, the interventions with fewer adherences were: ensuring that the collection bag does not touch the floor; respecting for maintaining a closed circuit. In article A6, the intervention with the lowest adherence was identified: daily review of the need to maintain the bladder catheter.

In all studies, training or instruction was provided to professionals, and in four of the articles both (training and instruction) (A3, A4, A5 and A7) were provided and in the other two are only training (A1 and A2).

With regard to the professionals' adhesion to the bundle, we found that two (A4 and A7) of the seven articles did not address this theme. Of the articles that analyzed it, only two (A5 and A6) have an adherence rate. The one with the most significant adherence rates is A6, with a 96% adherence rate in the bladder catheter insertion phase and 98.5% in the maintenance phase.

Only four analyzed articles concluded that the rate of adherence to the bundle by health professionals have influenced the results obtained (A1, A2, A5 and A7).

In order to encourage the professionals to adhere to the bundle, strategies were implemented in three of the analyzed articles (A2, A5 and A7). We noticed that in article A2 the strategy used went through training and instruction, involving all nurses, nursing assistants and doctors, through lectures, presentation slides, pamphlets and posters. Article A5 does not refer to the type of strategy and Article A7 states that it used monitoring to strictly implement bundle interventions.

Of the articles included in this review, two (A2 and A5) affirm the existence of improvement in the adhesion to the bundle after the implementation of the measures, and only article A5 presents numbers that support this statement, with an increase from 87% to 94.4% in membership.

In order to verify the implementation of bundle by professionals, five of the articles (A1, A2 A3, A4, A6 and A7) resorted to the use of a checklist. Article A5 used the infection control team as a means of monitoring.

The results were evaluated in all articles included (A1, A2, A3, A4, A5, A6 and A7), using the UTIABC incidence rate. In all the articles analyzed, there was a reduction in the incidence of UTIABC, as shown in Table 3↗.

The Article A5 states that other factors were influenced by the implementation of the bundle, namely the reduction in the rate of multi-resistant microorganisms from 61.54% to 58.72%. The remaining articles (A1, A2, A3, A4, A6, A7) do not present evidence of other results resulting from the application of the bundle, in addition to the reduction in the incidence of UTIABC.

Article A6 specified which microorganisms are most often isolated in urine culture: *Candida* spp. (25.8%) and *Escherichia coli* (15.2%).

Article A3, aimed at a higher incidence of UTIABC in female patients (24.13%), compared to male patients (10.62%).

No article has analyzed the costs.

It is transversal to all studies the reduction of the incidence rate of UTIABC. The greatest reduction was found in study A3 with 70.72%, which the authors justify with the association of the application of the bundle with weekly training and training, given to professionals, together with the constant presence of a nurse from the health control team for infection in the unit under study.

Despite all the studies showing similar results, the interventions that make up the bundle are not the same, which makes parallelization difficult. It should be noted that all bundles used by the authors are based on scientific evidence.

It is possible to infer that the education and training of professionals contributes positively to the success of the result of the application of the bundle. Another factor also taken into account is the professionals' adherence to the measures that make up the bundle.

Confronting our results with the pre-existing bibliography that addresses the topic, we found a systematic review of 2017 entitled "Systematic Review of Interventions to Reduce Urinary Tract Infection in Nursing Home Residents"[18] that seeks to understand the strategies to prevent UTIABC in nursing homes. Although the context is different from the one analyzed by us, and knowing a priori that this fact may influence the results, we found that the results achieved in our review are in line with those obtained in this analysis, since this suggests that the bundle has an impact on the reduction of UTIABC.

Regarding the documentation guiding the practice in Portugal, the rule 019/2015 of the DGS[19] "Beam of Interventions" for the Prevention of Urinary Infection Associated with Vesical Catheter" is available. From the analysis of the explained interventions, we found that some are in line with those identified as the most used in the studies included in this analysis. They are: to follow the aseptic technique in the procedure of bladder catheterization and connection to the drainage system; to comply with the clean technique, namely with correct hand hygiene and use of PPE's; to perform daily hygiene of the urethral meatus; to keep the bladder catheter with the collection bag constantly below the level of the bladder and deflated whenever 2/3 of its capacity has been reached; daily check the need to maintain a bladder catheter, removing it as soon as possible.

# CONCLUSION

Answering the research question posed at the beginning of the present review and after conducting the analysis of the studies, we can confirm that the application of bundle has evidence in decreasing the incidence rate of UTIABC in the adult patient in an ICU environment.

The set of interventions identified as likely to be part of the bladder catheter insertion bundle was: hand washing and placement of PPE's; hygiene of the perineum and disinfection of the meatus; use of aseptic technique during insertion. For the bladder catheter maintenance bundle, the most used set of interventions was: daily assessment of the

need to maintain bladder catheterization; keeping the urine collection bag below the level of the bladder; ensuring the maintenance of a closed system; emptying the collector bag as soon as it is 2/3 of the total.

We also concluded that the instruction, training and adherence to the bundle by nurses are facilitators of the implementation of bundle and catalysts of the results obtained.

We observed that of the studies included, none have been developed in the European continent. This fact represents a limitation of our systematic review, however, it allows us to attest to the need for new studies that address the issue and, consequently, bring subsidies to patient safety and quality of care provided to the person.

In terms of the implications for the investigation, we suggest that any future studies be carried out with high scientific rigor, considering only random controlled samples. The concern of authors of future studies should be to reduce the bias, especially by hiding the allocation. It would also be fruitful to carry out studies that will identify which interventions are most effective to include in the bundle.

**Authors Contributorship**

DI: Study design, bibliographical research, evaluation of the methodological quality of the articles, discussion and writing of the article.
AF: Study design, bibliographical research, data synthesis, discussion and writing of the article.
JD: Study design, bibliographical research, data extraction, discussion and article writing.
MB: Study design, bibliographical research, evaluation of the methodological quality of the articles, discussion and writing of the article.
SD: Study design, bibliographical research, data synthesis, discussion and writing of the article.
SC: Study design, bibliographical research, data extraction, discussion and article writing.
AR: Review, analysis, discussion and writing of the article.
All authors read and agreed with the published version of the manuscript.

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# REFERENCES

1. Infeções e Resistências aos Antimicrobianos – Relatório Anual do Programa Prioritário 2018 (Internet). Lisboa: Direção-Geral da Saúde; 2018 [cited 2020 Jun]. Available from: https://www.dgs.pt/portal-da-estatistica-da-saude/diretorio-de-informacao/diretorio-de-informacao/por-serie-1003038 pdf.aspx?v=%3d%3dDwAAAB%2bLCAAAAAAABAArySzItzVUy81MsTU1MDAFAHzFEfkPAAAA.

2. Davis, C. Catheter-associated urinary tract infection: signs, diagnosis, prevention. Br J Nurs. 2019;28:96-100. doi:10.12968/bjon.2019.28.2.96.

3. Mota EC, Oliveira AC. Catheter-associated urinary tract infection: why do not we control this adverse event?. Rev Esc Enferm USP. 2019;53:1-7. doi:10.1590/S1980-220X2018007503452.

4. Saran S, Rao NS, Azim A. Diagnosing catheter-associated urinary tract infection in critically ill patients: Do the guidelines help?. Indian J Crit Care Med. 2018;22:357-60. doi:10.4103/ijccm.IJCCM_434_17.

5. Gyesi-Appiah E, Brown J, Clifton A. Short-term urinary catheters and their risks: an integrated systematic review. Br J Nurs. 2020;29:16-22. doi:10.12968/bjon.2020.29.9.S16.

6. Sean MD, Angeliki BP. Guide to infection control in the healthcare setting: Bundles in Infection Prevention and Safety. International Society for Infectious Diseases. 2018 [cited 2020 Jun]. Available from: https://isid.org/wp-content/uploads/2019/06/ISID_GUIDE_BUNDLES_IN_INFECTION_PREVENTION_SAFETY.pdf.

7. Gesmundo, M. Enhancing nurses' knowledge on catheter-associated urinary tract infection (CAUTI) prevention. Kai Tiaki Nurs Res. 2016;7:32-40.

8. Joanna Briggs Institute. Systematic Review Resource Package: The Joanna Briggs Institute Method for Systematic Review Research Quick Reference Guide. Version 4.0. QJBC. Adelaide: JBI; 2015.

9. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. The PRISMA Group. 2009. BMJ. 2009;339:b2535. doi:10.1136/bmj.b2535.

10. Joanna Briggs Institute (Internet). Critical Appraisal Checklist for Quasi-Experimental Studies; 2017 [cited 2019 Nov]. Available from: https://joannabriggs.org/sites/default/files/2019-05/JBI_Quasi-Experimental_Appraisal_Tool2017_0.pdf.

11. Joanna Briggs Institute (Internet). Critical Appraisal Checklist for Cohort Studies; 2017 [cited 2019 Nov]. Available from: https://joannabriggs.org/sites/default/files/2019-05/JBI_Critical_Appraisal-Checklist_for_Cohort_Studies2017_0.pdf.

12. Yazici G, Bulut H. Efficacy of a care bundle to prevent multiple infections in the intensive care unit: A quasi-experimental pretest-posttest design study. Appl Nurs Res. 2018;39:4-10. doi:10.1016/j.apnr.2017.10.009.

13. Dehghanrad F, Nobakht-e-Ghalati Z, Zand F, Gholamzadeh S, Ghorbani M, Rosenthal V. Effect of instruction and implementation of a preventive urinary tract infection bundle on the incidence of catheter associated urinary tract infection in intensive care unit patients. Electron J Gen Med. 2019;16:1-9. doi:10.29333/ejgm/94099.

14. Ravi P, Joshi M. Role of "Bladder care bundle" and "Infection control nurse" in reducing catheter-associated urinary tract infection in a peripheral hospital. J Mar Med Soc. 2018; 20:116-21. doi:10.4103/jmms.jmms_8_18.

15. Prakash SS, Rajshekar D, Cherian A, Sastry AS. Care bundle approach to reduce device--associated infections in a tertiary care teaching hospital, South India. J Lab Physicians. 2017;9:273-8. doi:10.4103/JLP.JLP_162_16.

16. Gao F, Wu YY, Zou JN, Zhu M, Zhang J, Huang HY, et al. Impact of a bundle on prevention and control of healthcare associated infections in intensive care unit. J Huazhong Univ Sci Technolog Med Sci. 2015;35:283-90. doi:10.1007/s11596-015-1425-2.

17. Lai CC, Lee CM, Chiang HT, Hung CT, Chen YC, Su LH, et al. Implementation of a national bundle care program to reduce catheter-associated urinary tract infection in high-risk units of hospitals in Taiwan. J Microbiol Immunol Infect. 2017;50:464-70. doi: 10.1016/j.jmii.2017.01.006.

18. Gupta S, Al Khaleefah F, Al Harbi I, Ahmed F, Jabar S, Torre M, et al. An intervention study for the prevention and control of health care-associated infection in the critical cares area of a tertiary care hospital in Saudi Arabia. Indian J Crit Care Med. 2018;22: 858-61. doi:10.4103/ijccm.IJCCM_270_18.

19. Meddings J, Saint S, Krein S, Gaies E, Reichert H, Hickner A, et al. Systematic Review of Interventions to Reduce Urinary Tract Infection in Nursing Home Residents. J Hosp Med. 2017;12:356-68. doi:10.12788/jhm.2724.

20. Direção-Geral da Saúde. Norma 019/2015 atualizada a 30/05/2017. "Feixe de Intervenções" de Prevenção de infeção urinária associada a cateter vesical. Lisboa: DGS; 2017.

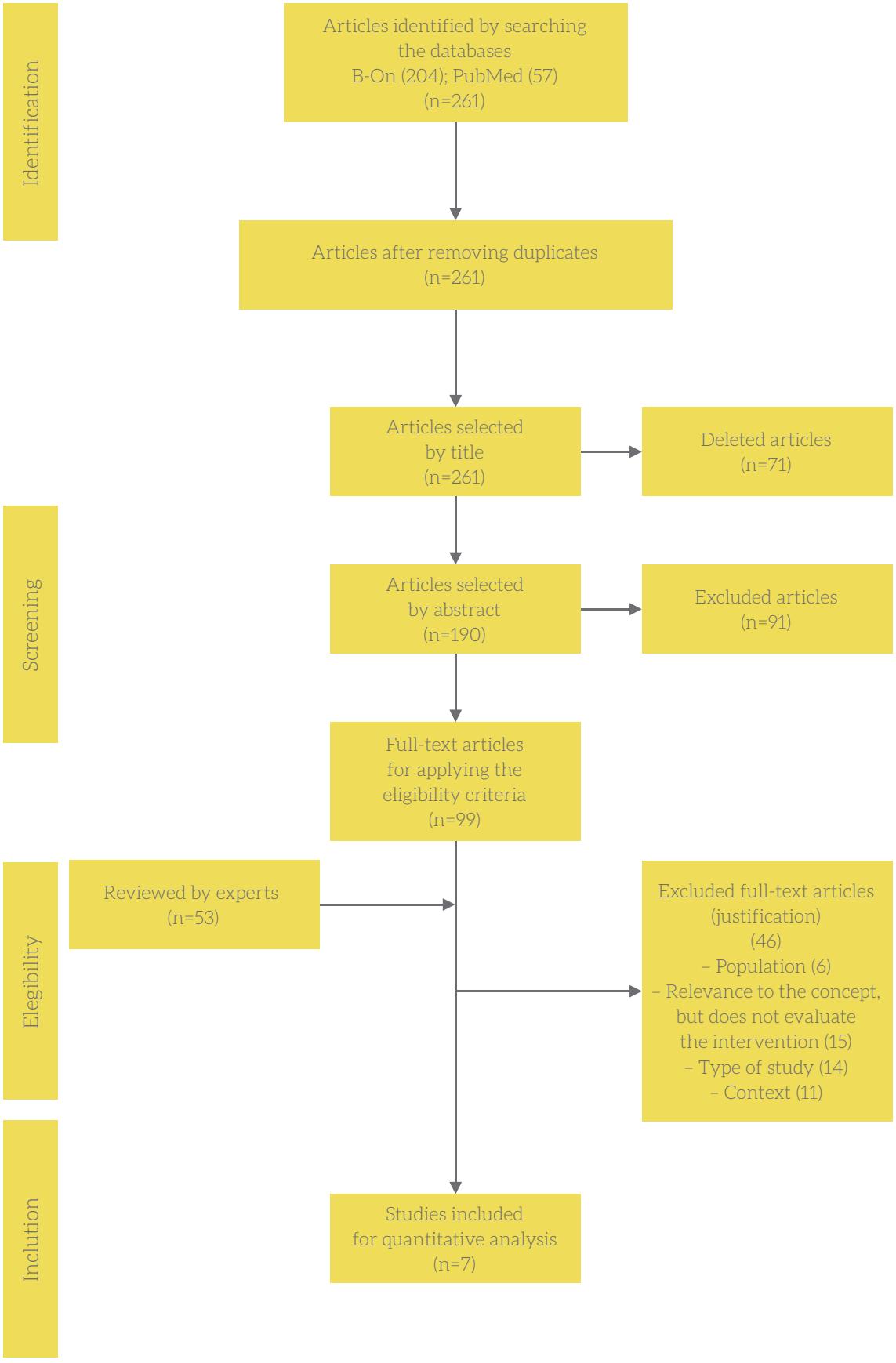


Figure 1 – PRISMA *Flow Diagram*.

Table 1 – Evaluation of methodological quality, Beja 2020.

| Code of article | Study | JBI evidence level | Quality/JBI methodological recommendation |
|---|---|---|---|
| A1 | Yazici & Bulut (2018) | Quasi-experimental (II-D) | (7/9) |
| A2 | Dehghanrad *et al* (2019) | Quasi-experimental (II-D) | (6/9) |
| A3 | Ravi & Joshi (2018) | Observational (III-E) | (9/11) |
| A4 | Prakash *et al* (2017) | Cohort (III-C) | (7/11) |
| A5 | Gao *et al* (2015) | Observational (III-E) | (8/11) |
| A6 | Lai *et al* (2017) | Observational (III-E) | (7/11) |
| A7 | Gupta *et al* (2018) | Observational (III-E) | (9/11) |

Table 3 – Results of bundle application, Beja 2020.

| Article | Reduction (%) |
|---|---|
| A1 | 14.93% |
| A2 | 57.50% |
| A3 | 51.44% |
| A4 | 70.72% |
| A5 | 8.33% |
| A6 | 22.80% |
| A7 | 42.10% |

Table 2 – Summary of the general characteristics of the studies included in the systematic review, Beja 2020.

| ID | Country/Year | Objective | Sample | Results | Conclusions |
|---|---|---|---|---|---|
| A1 | Turkey 2018 | – To evaluate the effectiveness of the bundle in preventing the three most frequent infections acquired in ICUs. | – 120 patients. | – After the application of the bundle, the UTIABC rate decreased from 6.7/1000 days of bladder catheter to 5.7/1000 days of bladder catheter. | – The implementation of the bundle reduced the rate of UTIABC;<br>– The increase in nurses' adherence to the use of the bundle contributes to the reduction of UTIABC rates. |
| A2 | Iran 2019 | – Identification of the impact of the formation and implementation of the bundle on the incidence of UTIABC. | – 330 patients were included (185 before and 145 after the intervention);<br>– Inclusion criteria: patient with a bladder catheter, aged over 18 years-old and without symptoms of urinary infection at the time of insertion of the bladder catheter. | – There was a reduction in the incidence of UTIABC after the intervention, the authors did not consider it significant. | – Although the formation and implementation of the bundle reduced UTIABC, this reduction was not significant. The training of professionals reduced non--adherence to the bundle. |
| A3 | India 2018 | – Study the impact of the application of the bundle on the incidence of UTIABC. | – 136 patients admitted to the ICU, male and female;<br>– Initial phase (8 months) 51 patients;<br>– Intervention phase (21 months) 85 patients:<br>a) Intervention phase I (8 months) 50 patients;<br>b) Intervention phase II (13 months) 35 patients. | – A 70.72% reduction in the incidence of UTIABC compared to the initial phase;<br>– Higher incidence of ITUACV in females (24.13%) compared to males (10.62%). | – The use of the bundle, together with the education of the team, reduced the incidence rate of UTIABC by 60.64%;<br>– When it was applied under constant supervision by the infection control nurse [ICN], the rate of reduction of UTIABC was clinically significant with 70.72%. |

Table 2 – Summary of the general characteristics of the studies included in the systematic review, Beja 2020.↔↖

| ID | Country/Year | Objective | Sample | Results | Conclusions |
|---|---|---|---|---|---|
| A4 | India 2017 | – To assess the impact of the application of the bundle in reducing infections associated with devices. | – 18 ICU's were analyzed;<br>– 300 patients were included. | – The baseline UTIABC rate was 4.86/1000 days of bladder catheter, in the implementation phase, it decreased to 3.39/1000 days of bladder catheter. In the post-implementation phase, the UTIABC rate reduced further to 2.36/1000 days of bladder catheter. | – The application of the bundle in adult patients admitted to the ICU significantly reduces the rate of UTIABC. |
| A5 | China 2015 | – To compare the incidence of IAHC in the ICU before and after the implementation of the bundle. | – 2774 patients were monitored: 1311 patients before and 1463 after the implementation of the bundle;<br>– 1726 male patients and 1048 female patients. | – The three types of infections associated with catheters under evaluation reduced their incidence after the implementation of the bundle;<br>– The rate of UTIABC before the bundle was 0.84/1000 days of bladder catheter and after the intervention 0.77/1000 days of bladder catheter. | – The implementation of the bundle and the training of professionals allowed the reduction in the incidence of UTIABC. |
| A6 | Taiwan 2017 | – To assess the impact of the application of the bundle on the incidence of UTIABC in ICUs. | – 13 ICU's have been analyzed.<br>– 196 patients were included. | – The baseline UTIABC rate was 3.86/1000 days of bladder catheter.<br>– In the post-implementation phase, the rate decreased to 2.98/1000 days of bladder catheter, representing a decrease of 22.7%. | – The application of the care bundle in adult patients admitted to the ICU reduces the rate of UTIABC. |

Table 2 – Summary of the general characteristics of the studies included in the systematic review, Beja 2020.

| ID | Country/Year | Objective | Sample | Results | Conclusions |
|---|---|---|---|---|---|
| A7 | Saudi Arabia 2018 | – To know the impact of the application of the bundle on the reduction of UTIABC in UCI;<br>– To compare the incidence of IAHC in the ICU, before and after the implementation of the bundle. | – 1,220 patients monitored (540 patients before the intervention and 680 patients after the intervention). | – For 6 months, of the 540 patients admitted to the ICU's before the intervention, 5.9% had IAHCs;<br>– For the same period, after the intervention, of the 680 patients admitted to ICUs, 3.4% had IAHCs;<br>– The most common infection was UTIABC;<br>– With the implementation of the bundle, there was a reduction from 3.52% to 1.52%. | – This study demonstrated that bundle implementation reduced 28% of hospital infections during the study period (the incidence rate of UTIABC decreased by 42%). |