

Nursing Challenges and Strategies for the Prevention and Management of Post-Transplant Infectious Complications: An Integrative Review

Antonia Mylene Sousa Almeida Lima^{1*} , Vanessa Sousa Bastos² , Lidyanne Cardoso Passos³ ,
Isadora Cristina Rodrigues Maramaldo⁴ , Mariangela Francisca Sampaio Araujo⁵ 

1. Centro Universitário Internacional Uninter  – Curitiba (PR) – Brazil.
2. Universidade Federal do Piauí  – Centro de Ciências da Saúde – Departamento de Enfermagem – Teresina (PI) – Brazil.
3. Faculdade de Educação São Francisco – Pedreiras (MA) – Brazil.
4. Hospital São Domingos  – São Luís (MA) – Brazil.
5. Centro Universitário Uninovafapi  – Teresina (PI) – Brazil.

*Corresponding author: enfamylene@gmail.com

Section editor: Patrícia Treviso 

Received: Feb. 20, 2026 | Approved: May 19, 2026

ABSTRACT

Objective: To analyze the main challenges related to infections in the post-transplant period and the nursing strategies aimed at their prevention and the management of associated complications. **Methodological pathway:** This is an integrative literature review. The guiding research question was formulated using the PICO strategy. The search was conducted between October and November 2025, with an update in May 2026, in the databases Medical Literature Analysis and Retrieval System Online (MEDLINE) via PubMed, Scopus, and Web of Science. Complete primary studies published between 2015 and 2025, in Portuguese, English, and Spanish, addressing care strategies and interventions related to the prevention, monitoring, and management of infections in patients undergoing solid organ transplantation were included. **Results:** Five studies met the eligibility criteria and comprised the final sample. The identified evidence demonstrated that immunosuppression remains one of the main factors associated with infectious vulnerability in transplant patients. The interventions described included nursing educational programs, implementation of care bundles, antimicrobial stewardship strategies, hospital infection control, and preventive measures aimed at the management of invasive devices and hygiene in daily care. The findings indicated reductions in healthcare-associated infection rates, antimicrobial consumption, length of hospital stay, and improvements in clinical and economic outcomes, although the evidence remains limited and methodologically heterogeneous. **Final considerations:** The available evidence suggests that systematized care strategies, especially nursing education, continuous clinical surveillance, early detection of infection signs, and implementation of standardized protocols, may contribute to the prevention and management of infectious complications in the post-transplant period. However, the scarcity of studies and the methodological limitations identified reinforce the need for more robust investigations to strengthen the scientific basis and support evidence-based care practices.

Descriptors: Infections; Organ Transplantation; Infection Control; Nursing Care; Postoperative Complications.

Desafios e Estratégias de Enfermagem na Prevenção e no Manejo de Complicações de Infecções Pós-Transplante: Uma Revisão Integrativa

RESUMO

Objetivo: Analisar os principais desafios relacionados às infecções no período pós-transplante e as estratégias de enfermagem voltadas à sua prevenção e ao manejo de complicações associadas. **Percurso metodológico:** Trata-se de uma revisão integrativa da literatura. A pergunta norteadora foi formulada utilizando a estratégia PICO. A busca foi realizada entre outubro e novembro de 2025, com atualização em maio de 2026, nas bases de dados *Medical Literature Analysis and Retrieval System Online* (MEDLINE) via *PubMed*, *Scopus* e *Web of Science*. Foram incluídos estudos primários completos, publicados entre 2015 e 2025, nos idiomas português,

inglês e espanhol, que abordassem estratégias assistenciais e intervenções relacionadas a prevenção, monitoramento e manejo de infecções em pacientes submetidos a transplante de órgãos sólidos. **Resultados:** Cinco estudos atenderam aos critérios de elegibilidade e compuseram a amostra final. As evidências identificadas demonstraram que a imunossupressão permanece como um dos principais fatores associados à vulnerabilidade infecciosa em pacientes transplantados. As intervenções descritas incluíram programas educativos em enfermagem, implementação de *bundles* assistenciais, estratégias de *stewardship* antimicrobiano, controle de infecção hospitalar e medidas preventivas voltadas ao manejo de dispositivos invasivos e à higiene no cuidado diário. Os achados apontaram redução nas taxas de infecções associadas à assistência, diminuição do consumo de antimicrobianos, redução do tempo de internação e melhora de desfechos clínicos e econômicos, embora com evidências ainda limitadas e metodologicamente heterogêneas. **Considerações finais:** As evidências disponíveis sugerem que estratégias sistematizadas de cuidado, especialmente educação em enfermagem, vigilância clínica contínua, detecção precoce de sinais de infecção e implementação de protocolos padronizados, podem contribuir para a prevenção e o manejo de complicações infecciosas no período pós-transplante. Entretanto, a escassez de estudos e as limitações metodológicas identificadas reforçam a necessidade de investigações mais robustas para fortalecer a base científica e subsidiar práticas assistenciais fundamentadas em evidências.

Descritores: Infecções; Transplante de Órgãos; Controle de Infecções; Cuidados de Enfermagem; Complicações Pós-Operatórias.

INTRODUCTION

Organ transplantation in Brazil began in 1964. However, the legal framework and coordination structure were only formalized in 1997, with the establishment of the National Transplant System (Sistema Nacional de Transplantes - SNT) by Law No. 9,434/1997¹. This system is responsible for coordinating, standardizing, and monitoring the execution of transplants throughout the national territory². Since its creation, there has been significant progress in transplant techniques, resulting in increased survival rates for transplant patients³.

Currently, organ and tissue transplantation is recognized as an effective therapeutic alternative for the treatment of various diseases, with the potential to improve patients' quality of life and life expectancy. Chronic diseases and organ failure are, in fact, the main causes that lead patients to need a transplant^{4,5}. The implementation of this therapy is preceded by confirmation of brain death or cardiorespiratory arrest, with brain death being defined as the complete and irreversible cessation of all brain functions⁶.

Although transplantation represents a significant advance in the treatment of terminal illnesses, the postoperative period presents serious challenges. To ensure organ acceptance and prevent rejection (acute or chronic), the patient must continuously adhere to a rigorous immunosuppression regimen. This therapy, which is fundamental to long-term transplant success, entails profound immunological vulnerability, making the patient susceptible to the invasion and proliferation of microorganisms^{7,8,9}.

In this immunosuppressive setting, infections stand out as the most frequent complications and represent a significant cause of morbidity and mortality in transplant recipients, especially in the first few months^{10,11}. The variety of etiological agents, including bacteria, fungi, viruses, and opportunistic microorganisms, demands a highly complex diagnostic and therapeutic approach. The occurrence of infection not only increases costs and length of hospital stay but also directly threatens the function of the transplanted organ, potentially leading to rejection and patient death^{12,13}.

Rigorous surveillance and the implementation of preventive and management strategies are essential in specialized post-transplant care, given the magnitude of infectious risks^{14,15}. In this context, nursing plays a crucial role in the multidisciplinary team. The nursing team is responsible for the continuous monitoring of early signs of infection, the precise administration of immunosuppressive therapy, and strict adherence to infection prevention and control protocols^{16,17,18}.

Considering the high incidence of infections in the post-transplant period, their direct association with increased morbidity and mortality, and the importance of nursing care in the early detection, prevention, and management of these complications, a deeper understanding of this phenomenon is justified. Understanding the factors that predispose to infections, coupled with an analysis of the care practices adopted, is essential to improve care and optimize therapeutic outcomes. Therefore, this article aims to analyze the main challenges related to infections in the post-transplant period and the nursing strategies focused on their prevention and the management of associated complications.

METHODOLOGICAL PATHWAY

This study is an integrative literature review designed to gather, analyze, and synthesize scientific evidence on a specific topic in a systematic and orderly manner, thereby contributing to the improvement of knowledge and care practices in the context of organ transplantation.

The integrative review was conducted according to the six classic steps proposed by Whittemore and Knafl¹⁹ and recommended by the Joanna Briggs Institute²⁰, ensuring methodological rigor and transparency in the synthesis of evidence: (1) identification of the problem and formulation of the research question; (2) definition of inclusion and exclusion criteria; (3) search in databases; (4) critical appraisal of the methodological quality of the included studies; (5) extraction, analysis, and synthesis of data; and (6) presentation and discussion of findings.

The research question was structured using the PICo (Population, Phenomenon of Interest, Context) strategy, in accordance with the JBI²⁰ guidelines, to ensure objectivity, focus, and coherence in the investigative process. Thus, the following was considered: P (Population) = patients undergoing solid organ transplantation; I (Phenomenon of Interest) = nursing strategies and care aimed at preventing and managing infections in the post-transplant period; Co (Context) = clinical and hospital transplant and postoperative follow-up units, where care practices aimed at preventing and managing infections occur. Based on this structure, the guiding question was formulated: "What are the main challenges and nursing strategies aimed at preventing and managing infections in patients in the post-transplant period?"

Based on the research question, controlled and uncontrolled descriptors were identified using the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) vocabularies. The terms were organized according to the PICo strategy (Table 1).

Table 1. PICo strategy and descriptors used in the searches.

PICo strategy	Controlled vocabulary (MeSH/DeCS)	Free-text terms / Search terms
P (Population): patients undergoing solid organ transplantation.	<i>organ transplantation; transplant recipients</i>	<i>solid organ transplant; post-transplant patient</i>
I (Phenomenon of interest): Nursing strategies and care for the prevention and management of post-transplant infections.	<i>nursing care; infection control; cross infection; postoperative complications; opportunistic infections</i>	<i>infection prevention; nursing intervention; infection management; infection control strategy</i>
Co (Context): clinical and hospital transplant and postoperative follow-up units.	<i>hospitals; postoperative care</i>	<i>clinical practice; hospital unit; post-transplant care setting</i>

Source: Elaborated by the authors.

Primary, full-text studies published between 2015 and 2025 in English, Portuguese, or Spanish were included. Eligible studies had to provide evidence on the prevention, monitoring, and management of infections in solid organ transplant recipients. This included healthcare interventions and care strategies applicable to nursing practice, while addressing patient safety challenges.

Secondary studies (reviews, editorials, book chapters, conference proceedings, monographs, dissertations, and theses), duplicate studies, and studies that did not address the review's guiding question or did not present care strategies for the prevention and management of infections in the post-transplant context were excluded.

The search was conducted between October and November 2025, and updated in May 2026, using the MEDLINE (via PubMed), Scopus, and Web of Science databases. Full-text access to the articles was obtained via the Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - CAPES), Journals Portal, authenticated through the Federated Academic Community (Comunidade Acadêmica Federada - CAFE) at the Federal University of Piauí (UFPI), ensuring ethical and legitimate access to the full texts.

The searches were conducted across the databases using a combination of controlled descriptors and free terms, utilizing the Boolean operators "AND" and "OR," according to the PICo structure. When relevant, quotation marks were used for compound expressions and truncation (*) for expanding terminological variations. The complete search strategies, applied filters, and the number of studies identified in each database are described below (Table 2).

The organization of references was carried out directly in the Rayyan[®] software, a collaborative review tool that enabled storage, duplicate identification, blind screening, and management of inclusion and exclusion decisions for studies.

The selection process was carried out independently by two reviewers, who read the titles and abstracts and selected studies that met the eligibility criteria for full-text review. In case of disagreement between the reviewers, the differences were resolved by a third reviewer, ensuring consistency and impartiality in the selection. The steps followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020²¹, encompassing identification, screening, eligibility, and final inclusion, as represented in the PRISMA 2020 flowchart.

Table 2. Search strategies by database.

Database	Search strategy applied	Filters applied	Results obtained
MEDLINE (via PubMed)	(("Organ Transplantation"[MeSH] OR "Transplant Recipients"[MeSH] OR "solid organ transplant*" OR "post-transplant patient*") AND ("Nursing Care"[MeSH] OR "Infection Control"[MeSH] OR "Cross Infection"[MeSH] OR "Postoperative Complications"[MeSH] OR "Opportunistic Infections"[MeSH] OR "infection prevention" OR "infection management" OR "infection control strateg*" OR "nursing intervention*" OR "nursing practice*") AND ("Hospitals"[MeSH] OR "Postoperative Care"[MeSH] OR "Health Personnel"[MeSH] OR "clinical practice" OR "hospital unit*" OR "post-transplant care" OR "transplant service*"))	Language: English, Portuguese, and Spanish; Period: 2015-2025; Species: Human	473
Scopus (Elsevier)	TITLE-ABS-KEY(("organ transplantation" OR "transplant recipient*" OR "solid organ transplant*" OR "post-transplant patient*") AND ("nursing care" OR "infection control" OR "cross infection" OR "postoperative complication*" OR "opportunistic infection*" OR "infection prevention" OR "infection management" OR "infection control strateg*" OR "nursing intervention*" OR "nursing practice*") AND ("hospital*" OR "postoperative care" OR "clinical practice" OR "post-transplant care" OR "transplant service*"))	Document type: Article; Language: English, Portuguese, and Spanish; Period: 2015-2025	1,755
Web of Science (Clarivate Analytics)	TS= (("organ transplantation" OR "transplant recipient*" OR "solid organ transplant*" OR "post-transplant patient*") AND ("nursing care" OR "infection control" OR "cross infection" OR "postoperative complication*" OR "opportunistic infection*" OR "infection prevention" OR "infection management" OR "infection control strateg*" OR "nursing intervention*" OR "nursing practice*") AND ("hospital*" OR "postoperative care" OR "clinical practice" OR "post-transplant care" OR "transplant service*"))	Document type: Article; Language: English, Portuguese, and Spanish; Period: 2015-2025	353

Source: Elaborated by the authors.

Data extraction was performed using a structured spreadsheet in Microsoft Excel®, previously validated by reviewers, ensuring the reliability and standardization of the process. The following information was collected: study identification (authors, year, objective, and country); methodological characteristics (design, sample, context, and type of transplant); nursing interventions aimed at preventing and managing infections; protocols used; and the main clinical and care outcomes. Additionally, the level of evidence of the included studies was classified according to the Johns Hopkins Nursing Evidence-Based Practice²² model, which categorizes research into levels I to V based on methodological robustness.

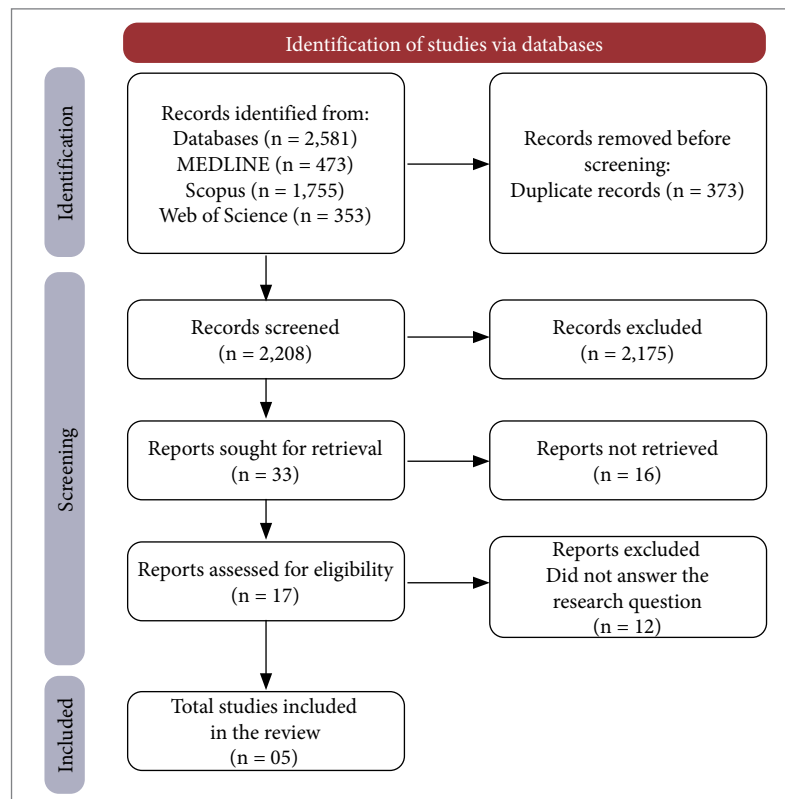
The data analysis was conducted descriptively and comparatively, allowing identification of key care strategies, gaps in clinical practice, and current trends in the management of post-transplant infections. The results were organized into summary tables, enabling an integrated interpretation of the findings and supporting a critical discussion of the available evidence.

RESULTS

The process of identifying, screening, assessing eligibility, and including studies was conducted according to the PRISMA 2020²¹ recommendations. Initially, 2,581 records were identified in the MEDLINE (n = 473), Scopus (n = 1,755), and Web of Science (n = 353) databases. After removing 373 duplicate records, 2,208 studies remained for screening.

During the screening of titles and abstracts, 2,175 studies were excluded for not addressing the review's central theme. Therefore, 33 articles were selected for full-text reading. However, 16 were excluded due to the unavailability of the full text, leaving 17 publications eligible for evaluation. In the final stage, 12 articles were excluded for failing to address the review's guiding question. Thus, five studies were included in the final sample (Fig. 1).

To characterize the included studies, a table was created that includes information on article identification, objectives, country of study, methodological design, sample, type of transplant, and level of evidence. This data allows for a comparative visualization of the methodological characteristics of the selected investigations (Table 3).



Source: Elaborated by the authors.

Figure 1. Selection workflow for studies included in the integrative review.

Table 3. Methodological characteristics of the included studies..

Author/Year	Objective	Country	Study design	Sample	Type of transplant	Level of Evidence
Parikh et al. ²³	Implementation of a bedside strategy for the prevention of immediate urinary tract infections (UTIs) in the early postoperative phase of renal transplantation.	India	Non-randomized, case-control study	50 recipients	Renal	III
Silva et al. ²⁴	To evaluate a combined intervention of an Antimicrobial Stewardship Program and Hospital Infection Control in kidney transplant recipients.	Spain	Quasi-experimental	196 recipients	Renal	II
Jorge-Huerta et al. ²⁵	To explore the application of a customized set of measures designed to reduce the incidence of infection in the first 12 months after kidney transplantation.	Spain	Prospective quasi-experimental	307 recipients	Renal	II
Wassef et al. ²⁶	To assess the impact of integrated care on reducing rates of device-associated infections.	Egypt	Retrospective quasi-experimental before-and-after study	57 recipients	Living-donor liver transplantation	II
El Hennawy et al. ²⁷	To investigate the incidence of recurrent UTIs and evaluate the financial impact of a comprehensive nursing education initiative.	Saudi Arabia	Retrospective cohort	100 recipients	Kidney transplantation	III

Source: Elaborated by the authors.

Five studies published between 2020 and 2025 were included, conducted across Saudi Arabia, Egypt, Spain, and India. The methodological designs comprised quasi-experimental studies, retrospective cohorts, prospective cohorts, and a case-control

pilot study. Sample sizes ranged from 50 to 307 participants, primarily involving kidney and liver transplant recipients. Regarding the level of evidence, the studies were predominantly classified as levels II and III.

Following the methodological characterization, data regarding the implemented interventions, healthcare strategies, evaluated outcomes, and main findings were synthesized (Table 4).

Table 4. Interventions, care strategies, and clinical outcomes of the included studies.

Author/year	Type of intervention	Applied strategy	Outcomes assessed	Key results
Parikh et al. ²³	Bedside preventive strategy for post-transplant UTI reduction.	Individualized use of disposable portable bedpans, cleaning with hypochlorite solution after use, and guidance for continuous use during hospitalization and after discharge.	Culture-positive UTI incidence, asymptomatic bacteriuria, graft dysfunction, length of stay, and treatment cost	The group that used individual bedpans reported no culture-positive UTIs, and there was a reduction in costs associated with post-transplant UTI treatment.
Silva et al. ²⁴	Antimicrobial stewardship and infection control	Antimicrobial auditing, hand hygiene, and standardized care protocols.	UTI rates and antimicrobial consumption.	There was a reduction in the consumption of broad-spectrum antimicrobials, a decrease in the incidence of cystitis and upper UTIs, and an improvement in infection control practices.
Jorge-Huerta et al. ²⁵	Individualized infection prevention bundle	Vaccination status review, latent infection screening, antimicrobial prophylaxis, immunological assessment, vitamin D and intravenous immunoglobulin supplementation, and individualized post-transplant recommendations.	Incidence of infection in the first year post-transplant, infection-related hospitalizations, serious bacterial infections, graft rejection, and mortality.	The intervention group showed greater adherence to preventive measures and a reduction in the incidence of post-transplant infections, infection-related hospitalizations, and serious bacterial infections within the first year after kidney transplantation.
Wassef et al. ²⁶	Implementation of a care bundle.	Standardized protocols for invasive devices.	Rates of ventilator-associated pneumonia (VAP), catheter-associated urinary tract infection (CAUTI), and central line-associated bloodstream infection (CLABSI)	Reduction of infection rates.
El Hennawy et al. ²⁷	Nursing education program.	Structured training program for nurses and educational guidance for transplant patients.	UTI recurrence and healthcare costs.	Reduction in UTI rates, shorter hospital stays, and lower healthcare costs.

Source: Elaborated by the authors.

The interventions described in the included studies highlight different care strategies in the post-solid-organ-transplant context. The identified approaches include structured educational interventions, implementation of standardized protocols, antimicrobial stewardship programs, individualized prevention bundles, and strategies focused on the management of invasive devices.

In the study by El Hennawy et al.²⁷, the intervention consisted of a nursing education program associated with guidance for transplant patients, and outcomes related to UTI recurrence and healthcare costs were evaluated. And the study by Wassef et al.²⁶ investigated the implementation of a protocol-based care package to prevent device-associated infections, observing a numerical reduction in rates after the intervention.

Silva et al.²⁴ evaluated a combined antimicrobial stewardship and infection control intervention in kidney transplant recipients, identifying reductions in broad-spectrum antimicrobial use and UTI rates. Similarly, Jorge-Huerta et al.²⁵ analyzed the implementation of an individualized preventive care bundle, including vaccination review, screening for latent infections, and immunological evaluation, and observed a reduction in post-transplant infections and hospitalizations. In turn, Parikh et al.²³ investigated a bedside preventive strategy based on the individual use of portable bedpans and hygiene measures, demonstrating a reduction in UTIs during the post-kidney transplant period.

The synthesis of the findings allowed the results to be organized into descriptive thematic categories (Table 5).

Table 5. Thematic categories derived from the interpretative analysis of the included studies.

Thematic category	Description based on studies	Studies
Nursing educational interventions	Structured training programs for nurses combined with educational guidance for transplant patients, with the evaluation of clinical and economic outcomes.	El Hennawy et al. ²⁷
Standardized care protocols	Implementation of care bundles for infection prevention.	Wassef et al. ²⁶ , Jorge-Huerta et al. ²⁵
Antimicrobial stewardship and infection control	Antimicrobial auditing and institutional prevention measures.	Silva et al. ²⁴
Preventive strategies in daily care	Practical hygiene measures and prevention of UTIs.	Parikh et al. ²³
Evaluation of care outcomes	Analysis of the impacts related to hospitalization and healthcare costs associated with interventions.	El Hennawy et al. ²⁷
Monitoring and reducing infectious outcomes	Evaluation of UTIs, VAP, CLABSI, and hospitalizations	All studies

Source: Elaborated by the authors.

The categories presented in Table 5 summarize the main types of interventions and outcomes investigated in the included studies, highlighting the diversity of care approaches analyzed in the post-transplant context.

In summary, the analyzed studies provide heterogeneous evidence on the types of interventions and outcomes evaluated, highlighting the limited availability of research on care strategies for the management of infections in the post-transplant context.

DISCUSSION

The findings of this integrative review demonstrate that the available evidence on care strategies to prevent and manage infections in patients undergoing solid organ transplantation remains limited and methodologically heterogeneous. Only five studies met the inclusion criteria, with heterogeneous methodological designs, a predominance of quasi-experimental studies, and small sample sizes, which restricts the robustness of the inferences.

Despite these limitations, the results indicate convergence regarding the relevance of structured nursing interventions, especially those based on systematized education and the implementation of standardized protocols. In the study by El Hennawy et al.²⁷, educational programs for nursing staff and transplant patients were associated with reduced UTI incidence, shorter hospital stays, and lower healthcare costs, demonstrating a positive clinical and economic impact.

These findings are consistent with recent evidence indicating that educational interventions focused on the transplant process can improve care outcomes by strengthening patients' knowledge and self-care and enhancing professional practice²⁸. Furthermore, a study indicates that structured nursing education contributes to a significant improvement in professional performance and adherence to infection prevention practices, directly impacting the quality of care and clinical outcomes²⁹.

In the study by Wassef et al.²⁶, the implementation of care bundles focused on the management of invasive devices was accompanied by a reduction in the rates of associated infections, including ventilator-associated pneumonia, catheter-associated urinary tract infection, and catheter-associated bloodstream infection. Similar results were observed by Jorge-Huerta et al.²⁵, who identified a reduction in infections and hospitalizations related to post-transplantation after the implementation of an individualized bundle of preventive measures, including infection screening, vaccination review, and immunological monitoring.

International literature demonstrates that device-related infections remain important determinants of morbidity and mortality in transplant patients, even when multifaceted strategies are adopted, indicating that such interventions are necessary but, on their own, insufficient to eliminate the risk³⁰.

These results suggest that structured nursing interventions, especially when combined with professional education, standardized practices, and systematic surveillance, tend to produce favorable clinical outcomes. However, the heterogeneity of the designs, the absence of randomized clinical trials, and the small number of available studies prevent the establishment of robust causal relationships or broad generalizations.

In a complementary manner, Silva et al.²⁴ demonstrated that strategies associated with antimicrobial stewardship and hospital infection control reduced the consumption of broad-spectrum antimicrobials and decreased urinary tract infection rates in kidney transplant recipients.

Another relevant aspect identified in the analysis refers to the need for continuous surveillance and early monitoring of infectious risks. Transplant patients present with pharmacological immunosuppression and multiple predisposing factors, which make them particularly susceptible to opportunistic infections and complications associated with invasive devices^{31,32}. In this context, the role of nursing in systematic clinical assessment and early identification of signs of deterioration is central to patient safety.

In addition to institutional and educational strategies, simple hygiene measures have also shown promising results. Parikh et al.²³ demonstrated a reduction in UTIs among kidney transplant recipients with the individualized use of portable bedpans, associated with hygiene protocols, reinforcing the importance of practical interventions in daily care.

Despite the identified evidence, there is a limitation in the number of available studies and methodological heterogeneity among them. The small number of studies identified underscores the scarcity of specific investigations into care strategies and interventions applicable to nursing practice in the context of post-transplant infections, reinforcing the need for multicenter studies and more robust designs to evaluate nursing interventions in this setting. Furthermore, future research should examine long-term outcomes and cost-effectiveness indicators to strengthen the scientific basis for clinical decision-making and health management.

Thus, although the included studies indicate potential benefits of the analyzed care strategies, the available findings are insufficient to support definitive conclusions about the magnitude of these interventions' impact. The body of evidence suggests promising trends, but reinforces the need to expand the empirical base to support more consistent clinical recommendations.

FINAL CONSIDERATIONS

This integrative review demonstrated that the available evidence on care strategies to prevent and manage infections in patients undergoing solid organ transplantation remains limited and heterogeneous. The included studies suggest that structured interventions, particularly nursing education programs and standardized care protocols, can improve clinical and care outcomes.

However, the small number of eligible studies and their methodological limitations prevent definitive conclusions about the magnitude of these effects. Thus, the need for investigations with more robust designs that allow for a consistent assessment of the effectiveness of nursing interventions in this context and support evidence-based clinical recommendations is highlighted.

CONFLICT OF INTEREST

Nothing to declare.

AUTHOR'S CONTRIBUTION

Substantive scientific and intellectual contributions to the study: Lima AMSA, VSB; **Conception and design:** Lima AMSA, VSB; **Data analysis and interpretation:** Lima AMSA, Bastos VS, Passos LC, Maramaldo ICR, Araujo MFS; **Article writing:** Lima AMSA, Bastos VS, Passos LC, Maramaldo ICR, Araujo MFS; **Critical revision:** Lima AMSA, Bastos VS, Passos LC, Maramaldo ICR, Araujo MFS; **Final approval:** Lima AMSA.

DATA AVAILABILITY STATEMENT

All datasets were generated or analyzed in the current study.

FUNDING

Not applicable.

DECLARATION OF USE OF ARTIFICIAL INTELLIGENCE TOOLS

The authors declare that no artificial intelligence tools were used in the preparation, writing, data analysis, or review of this manuscript.

ACKNOWLEDGEMENT

Not applicable.

REFERENCES

1. Brasil. Lei n.º 9.434, de 4 de fevereiro de 1997. Dispõe sobre a remoção de órgãos, tecidos e partes do corpo humano para fins de transplante e tratamento e dá outras providências. Diário Oficial da União. 1997 fev. 5; p. 1. [access on 2025 nov 6]. Available at: <https://pesquisa.in.gov.br/imprensa/jsp/visualiza/index.jsp?jornal=1&pagina=1&data=05/02/1997&totalArquivos=56>
2. Lima AMSA, Bastos VS, Aquino ACR, Maramaldo ICR, Soares MS, Oliveira JC, et al. Avanço do transplante de órgãos e tecidos no Maranhão: uma análise do Plano de Aceleração de 2023 a 2025. *Braz J Transplant*. 2025; 28: e4725. https://doi.org/10.53855/bjt.v28i1.722_PORT
3. Coelho GHF, Bonella AE. Doação de órgãos e tecidos humanos: a transplantação na Espanha e no Brasil. *Rev Bioét*. 2019 Jul/Set; 27(3): 419-429. <https://doi.org/10.1590/1983-80422019273325>
4. Brosi D, Wainstein M, Cervantes L, Schold JD. Global perspectives on transplant disparities. *Curr Opin Organ Transplant*. 2025 Apr; 30(2): 107-113. <https://doi.org/10.1097/MOT.0000000000001200>
5. Francis A, Harhay MN, Ong ACM, Tummalapalli SL, Ortiz A, Fogo AB, et al. Chronic kidney disease and the global public health agenda: an international consensus. *Nat Rev Nephrol*. 2024 Apr; 20: 473-485. <https://doi.org/10.1038/s41581-024-00820-6>
6. Dias JM, Magri MDF, Silva CP, Morceli G, Baquião LSM, Nóbrega MS. Negativa familiar para doação de órgãos sob a perspectiva da bioética: revisão integrativa. *Rev Pesqui Cuid Fundam*. 2025 Jul; 17: e13607. <https://doi.org/10.9789/2175-5361.rpcf.v17.13607>
7. Elalouf A. Infections after organ transplantation and immune response. *Transpl Immunol*. 2023 Apr; 77: 101798. <https://doi.org/10.1016/j.trim.2023.101798>
8. Katabathina V, Menias CO, Pickhardt P, Lubner M, Prasad SR. Complications of immunosuppressive therapy in solid organ transplantation. *Radiol Clin North Am*. 2016 Mar; 54(2): 303-319. <https://doi.org/10.1016/j.rcl.2015.09.009>
9. Moradi F, Bahrami M, Nasrollahian S, Shirazi PS, Ghoreyshi NS, Ghobadi M. Global challenges of bacterial infections in organ transplantation: assessment of risk factors and predominant bacterial pathogen profiles threatening liver, kidney, heart, and lung transplant recipients. *BMC Infect Dis*. 2025 Sep; 25: 1153. <https://doi.org/10.1186/s12879-025-11579-x>
10. Lin M, Mah A, Wright AJ. Infectious complications of liver transplantation. *AME Med J*. 2018 Jan; 3: 5. <https://doi.org/10.21037/amj.2017.12.10>
11. Freire MP, Pouch S, Manesh A, Giannella M. Burden and management of multi-drug resistant organism infections in solid organ transplant recipients across the world: a narrative review. *Transpl Int*. 2024 Jun; 37: 12469. <https://doi.org/10.3389/ti.2024.12469>
12. Meng F, Zhu C, Zhu C, Sun J, Chen D, Ding R, et al. Epidemiology and pathogen characteristics of infections following solid organ transplantation. *J Appl Microbiol*. 2024 Nov; 135 (12): lxae292. <https://doi.org/10.1093/jambio/lxae292>
13. Keyvanfar A, Tehrani S, Falah Tafti MF, Talebian N, Mohammadi Z, Hojabri M, et al. Cytomegalovirus infection contributes to acute rejection in solid organ transplant recipients: a systematic review and meta-analysis. *BMC Infect Dis*. 2025 Sep; 25: 1205. <https://doi.org/10.1186/s12879-025-11648-1>
14. Cardoso C, Bravo P, Messias A, Martins J, Oliveira C. Profilaxia no transplante renal. *Braz J Transplant*. 2024; 27: e3324. https://doi.org/10.53855/bjt.v27i1.608_PORT
15. Fernandes GM, Freitas IA, Vasconcelos LHF, Oliveira DF, Duarte NL. Principais complicações infecciosas no pós-operatório de transplante hepático: desafios diagnósticos e estratégias terapêuticas e profiláticas. *Rev Eletrônica Acervo Saúde*. 2024 Dec; 24(12): e19230. <https://doi.org/10.25248/reas.e19230.2024>
16. Rocha CCT, Lima AV Neto, Silva ABP, Farias VAS, D'Eca A Junior, Silva RAR. Nursing care for kidney transplant patients: a scoping review. *Aquichan*. 2021 Sep; 21(3): e2136. <https://doi.org/10.5294/aqui.2021.21.3.6>
17. Santos ALL, Santos GFD, Silva JMC, Macedo LA, Cirino MHS, Ferreira VMV, et al. A complexidade do cuidado de enfermagem em pacientes pós-transplante cardíaco: uma revisão integrativa. *Rev Contemp*. 2025 Mar; 5(3): e7611. <https://doi.org/10.56083/RCV5N3-009>
18. Rodrigues JAP, Lacerda MR, Galvão CM, Gomes IM, Meier MJ, Caceres NTG. Nursing care for patients in post-transplantation of hematopoietic stem cells: na integrative review. *Rev Bras Enferm*. 2021; 74(3): e20200097. <https://doi.org/10.1590/0034-7167-2020-0097>
19. Whitemore R, Knafl K. The integrative review: updated methodology. *J Adv Nurs*. 2005 Nov; 52(5): 546-553. <https://doi.org/10.1111/j.1365-2648.2005.03621.x>
20. Joanna Briggs Institute. JBI manual for evidence synthesis. Adelaide: JBI; 2020. <https://doi.org/10.46658/JBIMES-24-01>
21. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021 Mar; 372(71): 1-9. <https://doi.org/10.1136/bmj.n71>
22. Dang D, Dearholt SL, Bissett K, Ascenzi J, Whalen M. Johns Hopkins evidence-based practice for nurses and healthcare professionals: model and guidelines. 4th ed. Indianapolis: Sigma Theta Tau Intl; 2021.

23. Parikh M, Patel N, Konnur A, Gang S, Mohan R, Hegde U. Bedside strategy to prevent postrenal transplant urinary tract infection-non randomised, case control pilot study. *Indian J Transplant.* 2020 Jul-Sep; 14(3): 204-207. https://doi.org/10.4103/ijot.ijot_62_19
24. Silva JT, Montoro J, Pérez-Jacoiste Asín MA, Fernández-Ruiz M, Polanco N, González E, et al. A joint program of antimicrobial stewardship and hospital-acquired infection control to reduce healthcare-associated infections after kidney transplantation: The Hipomenes study. *Am J Transplant.* 2023 Dec; 23(12): 1949-1960. <https://doi.org/10.1016/j.ajt.2023.07.009>
25. Jorge-Huerta L, Silva JT, Fernández-Ruiz M, Rodríguez-Goncer I, Pérez-Jacoiste Asín MA, Ruiz-Merlo T, et al. Novel intervention based on an individualized bundle of care to decrease infection in kidney transplant recipients. *Transpl Infect Dis.* 2024 Aug; 26(6): e14354. <https://doi.org/10.1111/tid.14354>
26. Wassef MA, Ghaith DM, Hussien MM, et al. Bundle care approach to reduce device-associated infections in post-living-donor liver transplantation in a tertiary care hospital, Egypt. *BMC Infect Dis.* 2024 Jul; 24 (674). <https://doi.org/10.1186/s12879-024-09525-4>
27. El Hennawy HM, Safar O, El Madawie MZ, Gopiechand J, Tawhari I, El Nazer W, et al. Clinical and financial impacts of nursing education programs on recurrent urinary tract infections after kidney transplant: a cohort study. *BMC Nephrol.* 2025 May;26 (232). doi: <https://doi.org/10.1186/s12882-025-04153-9>
28. Oriol-Vila E, Rota-Musoll L, Molina-Robles E, Roure-Pujol C, Chiverches-Pérez E. Educational interventions for haemodialysis patients in the transplant process: a systematic review. *Nurs Open.* 2024 Dec; 11(12): e70104. <https://doi.org/10.1002/nop2.70104>
29. Johnson Z, Sarwar H, Abbas M, Bilal M, Shahzadi I. Effect of nurse-led educational intervention on knowledge and preventive practices for upper respiratory tract infection among pediatric nurses. *JHWCR.* 2025 May; 3(5): e292. <https://doi.org/10.61919/45cecg25>
30. Peruzzo MB, Oliveira Calegari L, Demarchi Foresto R, Tedesco-Silva H, Medina Pestana J, Requião-Moura L. Persistent mortality risk from device-related healthcare-associated infection in kidney transplant recipients despite multifaceted interventions: action calls for a zero-tolerance policy. *Transplant Direct.* 2025 Feb; 11(2): e1754. <https://doi.org/10.1097/TXD.0000000000001754>
31. Cheng Y-D, Huang C-H, Gau S-Y, Chung N-J, Huang S-W, Huang C-Y, et al. Risk of *Pneumocystis jirovecii* pneumonia among solid organ transplant recipients: a population-based study. *J Fungi.* 2023; 9(1): 23. <https://doi.org/10.3390/jof9010023>
32. Bezerra KC, Vieira CMAG, Oliveira-Filho EF, Reis CRS, Oriá RB. Susceptibility of solid organ transplant recipients to viral pathogens with zoonotic potential: a mini-review. *Braz J Infect Dis.* 2024 Mar-Apr; 28(2): 103742. <https://doi.org/10.1016/j.bjid.2024.103742>