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UNVEILING THE BURDEN OF CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS ACROSS CLINICAL SETTINGS: A REVIEW OF INCIDENCE, RISK FACTORS, AND OUTCOMES

Bunga Ayasi Krisania [1,*], Puspa Wardhani [2,*] and Artaria Tjempakasari [3]

[1] Medical Study Program, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.
[2] Department of Clinical Pathology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.
[3] Department of Internal Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.
* Corresponding Author

ORCID Details
Bunga Ayasi Krisania: https://orcid.org/0009-0007-2124-9082
Puspa Wardhani: https://orcid.org/0000-0003-2202-8090
Artaria Tjempakasari: https://orcid.org/0000-0003-3264-8568

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ABSTRACT

Central line-associated bloodstream infection (CLABSI) remains a significant healthcare-associated complication linked to morbidity, prolonged hospitalization, increased healthcare costs, and mortality. Its burden varies across clinical settings and is influenced by patient characteristics, catheter exposure, healthcare practices, and surveillance methods. This review aims to synthesize evidence published between 2016 and 2026 regarding CLABSI incidence, risk factors, microbiological characteristics, clinical outcomes, and prevention across diverse healthcare settings. The review examines evidence from intensive care units, general medical and surgical wards, oncology and hematology, neonatal and pediatric units, and hemodialysis settings, considering differences in surveillance definitions and study populations. Reported CLABSI rates varied across settings. Multinational intensive care unit surveillance reported a pooled rate of 4.82 infections per 1,000 central-line days, whereas multicenter surveillance in India reported 8.83 infections per 1,000 central-line days, with the highest rate observed in neonatal intensive care units. Reported risk factors included prolonged catheterization, multilumen catheters, repeated catheterization episodes, severe illness, immunosuppression, older age, diabetes mellitus, parenteral nutrition, and inconsistent adherence to infection-prevention practices. CLABSI was associated with sepsis, prolonged hospitalization, recurrent infection, catheter removal or replacement, increased healthcare costs, and mortality. However, these outcomes require cautious interpretation because of differences in case definitions, baseline illness severity, and surveillance practices. In conclusion, CLABSI remains an important concern across clinical settings. Prevention requires appropriate catheter selection, aseptic insertion and maintenance, healthcare worker training, consistent surveillance, and timely removal of unnecessary catheters. Standardized definitions, exposure-adjusted reporting, and robust multicenter studies are needed to improve comparisons and clarify clinical outcomes.

Keywords: Central Line-Associated Bloodstream Infection; Incidence; Risk Factors; Clinical Outcomes; Healthcare-Associated Infections; Infection Prevention.

1 INTRODUCTION

Central venous catheters (CVCs) are integral to modern healthcare, providing vascular access for the administration of medications, fluids, blood products, and parenteral nutrition, as well as hemodynamic monitoring and other specialized interventions. They are widely used in intensive care, oncology and hematology, neonatal and pediatric care, perioperative medicine, and other clinical services. Despite their therapeutic importance, CVCs provide a potential route for microorganisms to enter the bloodstream and may facilitate microbial adherence and biofilm formation. Central line-associated bloodstream infection (CLABSI) therefore remains an important target for healthcare-associated infection prevention (Buetti et al., 2022; Buetti et al., 2025).

The consequences extend beyond a positive blood culture. A suspected or confirmed catheter-associated infection may prompt antimicrobial treatment, additional diagnostic procedures, catheter removal or replacement, and reassessment of vascular access. In vulnerable patients, bloodstream infection may complicate an already critical clinical course and contribute to organ dysfunction, prolonged hospitalization, increased healthcare costs, and mortality. The magnitude of these consequences depends on the patient's underlying illness, causative pathogen, infection severity, availability of effective antimicrobial therapy, and timeliness of source control (Buetti et al., 2025).

Nevertheless, the burden of CLABSI is not uniform across healthcare settings. ICU patients often have severe acute illness, multiple invasive devices, frequent catheter access, and prolonged exposure to hospital care. Patients with malignancy or hematological disorders may have immunosuppression and require long-term central access. Neonates and children have distinct physiological characteristics, device requirements, and patterns of exposure. General medical and surgical wards may have lower-intensity monitoring than ICUs but still manage patients with substantial catheter exposure. These differences affect both the probability of infection and the way infections are detected and reported (Buetti et al., 2022; Parveen et al., 2025).

The problem is particularly important when comparing healthcare systems with different resources. In a multinational prospective surveillance study covering 728 ICUs in 41 countries, the pooled CLABSI rate was 4.82 infections per 1,000 central-line days (Rosenthal et al., 2023). A seven-year multicenter surveillance study in India, covering adult, pediatric, and neonatal ICUs from May 2017 to April 2024, reported an overall rate of 8.83 per 1,000 central-line days (Parveen et al., 2025). These estimates demonstrate the importance of context-specific surveillance; however, they should not be interpreted as directly comparable measures of national performance because their populations, surveillance arrangements, and observation periods differ.

CLABSI is primarily a surveillance classification that identifies a bloodstream infection meeting specified criteria in a patient with an eligible central line. Previous evidence syntheses have examined CLABSI epidemiology, risk factors, and prevention strategies. However, a review spanning multiple clinical settings must also address the consequences of inconsistent definitions, differences in catheter exposure, heterogeneous microbiology, and unequal availability of infection-prevention resources. The purpose of this review is therefore to critically synthesize evidence published between 2016 and 2026 on CLABSI incidence, associated risk factors, microbiological characteristics, clinical outcomes, and prevention across diverse healthcare settings, while identifying the methodological limitations that constrain interpretation.

2 REVIEW CONTENT

2.1 Central line-associated bloodstream infection

2.1.1 Definition of Central line-associated bloodstream infection

CLABSI is primarily a surveillance-based classification used to identify bloodstream infections that meet established criteria for association with a central line. Under the United States Centers for Disease Control and Prevention's National Healthcare Safety Network (CDC/NHSN) framework, classification is based on defined central-line eligibility, timing requirements, and bloodstream infection criteria. However, this classification does not necessarily confirm that the catheter itself is the biological source of infection (Buetti et al., 2022; Centers for Disease Control and Prevention, 2026).

This distinction has important clinical implications. A bloodstream infection occurring in a patient with a central line may originate from another infectious focus or arise through a mechanism unrelated to the device. Therefore, surveillance-based classification should be distinguished from clinical attribution of causality, as these approaches serve different purposes in infection monitoring and patient management. Consistent application of standardized

criteria and consultation of the most recent NHSN protocols are essential for accurate classification and reliable comparisons across healthcare settings (Buetti et al., 2022; Centers for Disease Control and Prevention, 2026).

2.1.2 Epidemiology and incidence across clinical settings

2.1.2.1 Intensive care units

ICUs represent a major focus of CLABSI research because central venous access is frequently required for patients with severe illness, hemodynamic instability, and complex treatment needs (Rosenthal et al., 2023).

A multinational prospective cohort study conducted across 728 ICUs in 41 countries between 1998 and 2022 reported 3,537 CLABSI events during 1,815,043 patient-days and a pooled rate of 4.82 per 1,000 central-line days. The analysis identified longer hospitalization, increasing central-line exposure, surgical hospitalization, tracheostomy use, and institutional or country-level characteristics among factors associated with infection (Rosenthal et al., 2023). Because the observation period spans more than two decades and includes diverse healthcare systems, its pooled estimate should not be interpreted as a current universal benchmark.

More recent multicenter surveillance from India, covering May 2017 to April 2024, recorded 8,629 laboratory-confirmed CLABSI events during 977,052 central-line days. The overall rate was 8.83 per 1,000 central-line days, with reported rates of 8.68 in adult ICUs, 6.71 in pediatric ICUs, and 13.86 in neonatal ICUs (Parveen et al., 2025). These findings highlight the burden documented in that surveillance network and the importance of examining ICU subtypes separately. They do not establish that the same rates apply to all Indian hospitals or to other countries.

Taken together, these studies support the need for consistent exposure-adjusted surveillance and stratification by patient population. They do not justify ranking countries or hospitals without examining surveillance completeness, case definitions, patient mix, device utilization, and resource availability (Rosenthal et al., 2023; Parveen et al., 2025).

2.1.2.2 General medical and surgical wards

Central lines are also used outside ICUs, including for prolonged antimicrobial therapy, complex medication regimens, parenteral nutrition, and postoperative care. In these settings, differences in catheter maintenance, staff training, frequency of line access, and recognition of infection may affect observed rates (Rosenthal et al., 2025).

The CDC/NHSN surveillance framework includes eligible inpatient locations beyond traditional ICUs, allowing central-line-associated events to be monitored across wards and specialized units (Centers for Disease Control and Prevention, 2026). However, comparisons between wards and ICUs require attention to the populations under surveillance and the way device-days are collected.

The current draft does not establish a verified, representative incidence range for general wards. This gap should be addressed through the planned database search, prioritizing studies that report both infection events and central-line-day denominators.

2.1.2.3 Oncology and hematology

Patients receiving cancer treatment may require long-term central access for chemotherapy, transfusions, supportive treatment, and repeated blood sampling. Hematological malignancy and immunosuppression may increase vulnerability to infection, while long catheter duration and repeated access create additional opportunities for contamination (Rosenthal et al., 2025).

However, oncology and hematology populations are heterogeneous. A tunneled catheter used for months in an ambulatory patient differs substantially from a temporary multilumen catheter used during an acute inpatient admission. Neutropenic bloodstream infections may also be difficult to attribute to the catheter, especially when mucosal barrier injury or another infection source is plausible.

Consequently, the review should distinguish surveillance-defined CLABSI from clinically adjudicated catheter-related bloodstream infection (CRBSI) and, where relevant, from mucosal barrier injury laboratory-confirmed bloodstream infection (MBI-LCBI) categories (Centers for Disease Control and Prevention, 2026). Setting-specific studies are required before drawing firm conclusions about incidence or pathogen predominance in oncology and hematology.

2.1.2.4 Neonatal and pediatric units

Neonates and children require separate consideration because body size, developmental physiology, catheter type, underlying congenital disease, and treatment requirements differ from those of adults.

The Indian multicenter surveillance study reported a higher CLABSI rate in neonatal ICUs than in its adult and pediatric ICU groups (Parveen et al., 2025). This is an important setting-specific finding, although differences in case mix, catheter utilization, and surveillance practices must be considered before attributing the difference to any single mechanism.

A 2025 systematic review and meta-analysis of 17 cohort studies involving 15,221 pediatric patients identified associations between CLABSI and blood transfusion, congenital disease, central nervous system disease, total parenteral nutrition, multiple catheters, and prolonged catheterization. The reported estimates provide evidence that pediatric risk profiles include both patient-related and potentially modifiable exposure factors (Li et al., 2025). They should be interpreted in the context of the included populations and study methods rather than extrapolated uniformly to all pediatric services.

2.1.2.5 Hemodialysis and other specialized settings

Hemodialysis requires reliable vascular access, and some patients depend on central venous catheters when a suitable arteriovenous fistula or graft is unavailable or not usable. Repeated access, prolonged catheter dependence, and the consequences of losing vascular access make bloodstream infection a clinically important complication in this population (Rosenthal et al., 2025).

However, hemodialysis-specific catheter infection outcomes should not automatically be equated with conventional inpatient CLABSI. Studies may use definitions of access-related bloodstream infection, CRBSI, or primary bloodstream infection that differ from NHSN surveillance. The type of vascular access, frequency of dialysis sessions, microbiological sampling, and exposure denominator also affect comparisons.

A dedicated hemodialysis synthesis should therefore report the specific catheter type, infection definition, number of dialysis sessions or catheter-days, microbiological confirmation, and criteria for attributing infection to the access device. This is necessary to compare dialysis populations meaningfully with ICU or ward cohorts (Rosenthal et al., 2025).

2.1.2.6 Geographical and temporal variation

Observed incidence reflects both biological risk and the performance of surveillance and prevention systems. Differences in staffing, availability of antiseptics and dressings, training, laboratory capacity, microbiological testing, and adherence to protocols may influence infection risk and its detection (Rosenthal et al., 2025).

A position paper from the International Society for Infectious Diseases highlights the continuing importance of CLABSI prevention in both high-income and resource-limited healthcare systems (Rosenthal et al., 2025). Multicountry surveillance and the multicenter Indian findings provide further evidence that reported rates can differ substantially between settings (Rosenthal et al., 2023; Parveen et al., 2025).

Temporal trends also require caution. Improved surveillance can initially increase the number of recognized events, whereas a change in case definitions may create an apparent increase or decrease unrelated to a true change in infection risk. Conversely, an observed decline after a prevention program may be affected by concurrent changes in case mix, catheter use, laboratory practices, or reporting completeness (Centers for Disease Control and Prevention, 2026; Rosenthal et al., 2025).

2.1.3 Risk Factor of Central line-associated bloodstream infection

Central line-associated bloodstream infection (CLABSI) is a multifactorial healthcare-associated infection resulting from interactions between patient susceptibility, catheter characteristics, healthcare practices, and microbial factors. The relative contribution of these factors varies across clinical settings and patient populations. Identifying modifiable risk factors is essential for developing targeted prevention strategies, whereas non-modifiable factors can help identify patients who may require closer monitoring (Rosenthal *et al*., 2023; Huang *et al*., 2024).

2.1.3.1 Patient-related factors

Severity of illness and prolonged hospitalization. Critically ill patients frequently require invasive devices, intensive monitoring, and complex treatment, potentially increasing their susceptibility to infection and extending the duration of catheter exposure. In a multinational prospective study involving 728 intensive care units (ICUs) across 41 countries, Rosenthal *et al.* (2023) found that the risk of CLABSI increased with hospital length of stay and the number of central-line days. These findings emphasize the importance of considering both patient severity and cumulative catheter exposure when evaluating infection risk.

Immunosuppression and malignancy. Patients with hematological malignancies, chemotherapy-associated immunosuppression, or other impaired immune responses may have a reduced capacity to contain microbial invasion.

Huang *et al.* (2024) identified immunosuppression as a factor associated with central catheter bloodstream infection in ICU populations (OR 2.87; 95% CI 2.08–3.95). However, patients with malignancies may also develop bloodstream infections through mucosal barrier injury or other non-catheter sources, complicating the attribution of infection specifically to central venous access.

Age and comorbidities. Age and underlying medical conditions may influence susceptibility to CLABSI. Huang *et al.* (2024) reported associations between infection and age of at least 60 years (OR 2.19; 95% CI 1.76–2.73), diabetes mellitus (OR 3.06; 95% CI 2.56–3.66), and higher APACHE II scores (OR 1.84; 95% CI 1.54–2.20). In pediatric populations, Li *et al.* (2025) identified congenital disease, central nervous system disorders, blood transfusion, and total parenteral nutrition as factors associated with CLABSI. These findings demonstrate that patient-related risk factors differ across age groups and clinical settings and should not be generalized without considering population characteristics and study methodology.

2.1.3.2 Catheter related factors

Duration of catheterization. Longer catheter exposure provides additional opportunities for microbial contamination, adherence to catheter surfaces, and biofilm development. In a systematic review and meta-analysis of ICU studies, Huang *et al.* (2024) reported increasing odds of central catheter bloodstream infection at catheter-duration thresholds of at least five days (OR 2.07; 95% CI 1.41–3.03), seven days (OR 3.62; 95% CI 2.65–4.97), and 14 days (OR 4.85; 95% CI 3.35–7.01). These findings represent pooled associations and should not be interpreted as universal causal effects or precise biological cutoffs applicable to every patient. Daily assessment of catheter necessity remains an important prevention measure (World Health Organization, 2026).

Multiple-lumen catheters. Multilumen catheters facilitate the simultaneous administration of medications, fluids, and other therapies. However, additional lumens may increase the frequency of catheter manipulation and opportunities for contamination. Huang *et al.* (2024) reported an association between multilumen catheter use and infection (OR 3.41; 95% CI 2.27–5.11). Because multilumen devices may be preferentially used in more severely ill patients, confounding by indication must be considered. The minimum number of lumens required for safe clinical management should therefore be selected according to patient needs.

Repeated catheter insertion and replacement. Repeated insertion or replacement may introduce additional opportunities for microbial contamination and mechanical complications. Huang *et al.* (2024) reported an association between the number of catheter indwelling episodes and infection (OR 3.50; 95% CI 2.93–4.17). Nevertheless, this association does not establish that replacement itself causes infection, because repeated procedures may also reflect greater illness severity, catheter dysfunction, or previous complications. Unnecessary catheter replacement should be avoided, while suspected infection should be managed according to clinical findings and applicable guidelines.

Insertion site and catheter type. Insertion site may influence infection risk as well as mechanical complications and thrombosis. In the multinational ICU study, Rosenthal *et al.* (2023) reported higher CLABSI risk estimates for internal jugular and femoral central lines than for peripherally inserted central catheters (PICCs). However, site selection must account for clinical indication, duration of access, mechanical risks, and patient characteristics. Catheter type also matters because short-term nontunneled central venous catheters, tunneled catheters, PICCs, and implanted devices differ in their intended use, maintenance requirements, and patient populations. Device and site selection should therefore be individualized while following evidence-based prevention guidance (Rosenthal *et al*., 2023; World Health Organization, 2026).

2.1.3.3 Procedural and healthcare-system factors

Aseptic insertion and hand hygiene. Failure to maintain aseptic technique may introduce microorganisms during catheter insertion or subsequent manipulation. Hand hygiene, appropriate skin antisepsis, and maximal sterile barrier precautions are foundational preventive measures. The World Health Organization (2026) emphasizes appropriate staff training, hand hygiene, and aseptic technique throughout the catheter lifecycle, including insertion, maintenance, access, replacement, and removal.

Hub disinfection and catheter maintenance. Microbial contamination can occur after insertion through manipulation of catheter hubs, connectors, and access ports. Consistent disinfection before access, aseptic handling, appropriate dressing care, and regular assessment of the insertion site are therefore essential. The 2022 acute-care prevention recommendations by Buetti *et al.* (2022) emphasize the implementation of standardized insertion and maintenance practices, including hand hygiene, hub disinfection, and aseptic catheter care. These measures should be maintained throughout catheter use rather than being limited to the insertion procedure.

Staff training and protocol adherence. Written policies alone do not ensure reliable implementation. Staff competency, standardized procedures, accessible supplies, audit and feedback, and organizational support all influence adherence

to infection-prevention practices. The World Health Organization (2026) recommends education and training for healthcare workers involved in catheter insertion, maintenance, access, replacement, and removal. Multimodal implementation strategies can support the translation of guidelines into routine clinical practice.

Surveillance and feedback. Reliable surveillance enables healthcare facilities to monitor infection trends, evaluate preventive interventions, and identify areas requiring improvement. The CDC/NHSN protocol provides standardized criteria for identifying and reporting CLABSI events (Centers for Disease Control and Prevention, 2026). Surveillance data are most useful when definitions remain consistent, catheter exposure is accurately recorded, and findings are communicated to clinical teams. The World Health Organization (2026) also emphasizes surveillance and multimodal implementation as components of effective catheter-associated infection prevention.

2.1.3.4 Microbiological and treatment related factors

Biofilm formation. Microorganisms may adhere to catheter surfaces and develop into biofilms, in which microbial cells are embedded within an extracellular matrix. Biofilm formation can facilitate persistent colonization and reduce susceptibility to antimicrobial agents and host immune responses. In a systematic review of 25 studies, Cangui-Panchi *et al.* (2022) found that the proportion of clinical isolates capable of forming biofilms ranged from 59% to 100%, although estimates varied according to study methods, microbial species, and geographical setting. Biofilm formation provides a plausible mechanism for persistent catheter-associated infection but should not be assumed to be present in every CLABSI episode.

Prior antimicrobial exposure. Previous antimicrobial exposure may alter the microbial ecology and select for resistant organisms. Huang *et al.* (2024) reported an association between extensive antibiotic use and central catheter bloodstream infection in ICU populations (OR 3.54; 95% CI 1.65–7.61). This association should be interpreted cautiously because previous antibiotic use may also reflect underlying illness severity, prior infection, or greater healthcare exposure. Antimicrobial exposure is therefore a potential risk marker as well as a possible contributor to resistance selection.

Antimicrobial resistance. Resistant microorganisms may complicate empirical treatment, limit therapeutic options, and increase the consequences of delayed or ineffective therapy. The microorganisms responsible for catheter-associated infection and their resistance profiles vary across regions, healthcare settings, and patient populations. Local microbiological surveillance and susceptibility data are therefore important for informing empirical treatment and prevention strategies. Resistant pathogens should not be assumed to have a uniform distribution across all clinical settings (World Health Organization, 2026).

2.1.4 Clinical Outcomes

2.1.4.1 Sepsis and severe infection

Central line-associated bloodstream infection (CLABSI) is associated with serious clinical complications, including sepsis, septic shock, and organ dysfunction. The severity of these outcomes varies according to the causative pathogen, underlying comorbidities, immune status, and clinical condition at the time of infection. A systematic review by Alshahrani et al. (2023) described the substantial clinical impact of CLABSI, including increased morbidity and mortality in hospitalized patients. However, a surveillance-defined CLABSI event does not independently establish the presence of sepsis or prove that the catheter was the biological source of infection.

Studies should therefore distinguish CLABSI identified using surveillance criteria from clinically diagnosed sepsis and catheter-related bloodstream infection. Clinical severity should be evaluated using explicit diagnostic criteria and outcomes such as organ dysfunction, hemodynamic instability, microbiological clearance, and response to antimicrobial treatment (Alshahrani et al., 2023; Tao et al., 2026).

2.1.4.2 Prolongod hospitalization and healthcare utilization

CLABSI may increase healthcare utilization through additional diagnostic investigations, antimicrobial treatment, catheter management, and prolonged inpatient care. Chovanec et al. (2021) found that patients with CLABSI had an average hospital stay two days longer than patients with central venous catheters who did not develop CLABSI. The study also reported higher hospital mortality and readmission among infected patients.

More recently, Tao et al. (2026) conducted a propensity score-matched study across hospital departments. After matching, the median length of stay was 34 days in the CLABSI group compared with 14 days in the non-CLABSI group. These findings support an association between CLABSI and increased hospital utilization, although the magnitude of the difference may vary between healthcare systems and patient populations.

A major methodological challenge is that prolonged hospitalization can increase the time during which patients are exposed to infection risk, while CLABSI may itself extend hospitalization. Studies should therefore account for infection timing, baseline illness severity, and relevant confounders before interpreting additional hospital days as attributable to infection (Chovanec et al., 2021; Tao et al., 2026).

2.1.4.3 Catheter removal, replacement, and loss of vascular access

Catheter management is an important component of clinical outcomes because retaining an infected device may compromise infection control, whereas removal or replacement may introduce procedural risks and limit future vascular access. In patients with multidrug-resistant CLABSI, Burnham, Rojek and Kollef (2018) reported a strong association between failure to remove the catheter and 30-day mortality. As this was a retrospective, single-centre study, the findings should be interpreted in light of potential confounding and differences in patient severity.

Evidence regarding the timing of catheter removal is not entirely consistent. Johns, Wahlrab and Elefritz (2022) found that a composite outcome involving infection-related mortality, persistent bacteremia, and recurrent bacteremia occurred more frequently when catheter removal was delayed, although the difference was not statistically significant. This finding illustrates the limitations of small observational studies in determining the optimal timing of intervention.

Catheter salvage may be considered in selected clinical circumstances, but it requires careful assessment and follow-up. Ranganath et al. (2025) compared antibiotic lock therapy with catheter removal and found a higher risk of microbiological relapse within 90 days among patients receiving antibiotic lock therapy. These findings support reporting catheter removal, catheter salvage, procedural complications, microbiological relapse, and subsequent vascular access availability as separate outcomes.

2.1.4.4 Recurrent infection and treatment failure

Persistent or recurrent bloodstream infection may indicate incomplete source control, an unresolved infectious focus, antimicrobial resistance, or patient-related factors. Huerta et al. (2018) evaluated recurrence and mortality among patients with healthcare-associated CLABSI. Among 366 eligible cases, 22.1% experienced death or recurrent infection within 60 days after completing antimicrobial treatment; recurrent infection occurred in 7.1% and mortality in 16.9%. The study also identified illness severity and age as factors associated with the combined outcome.

Treatment strategy may influence recurrence. In a retrospective cohort study, Ranganath et al. (2025) reported microbiological relapse within 90 days in 20% of patients managed with antibiotic lock therapy compared with 7% of patients whose catheters were removed. These findings highlight the importance of distinguishing persistent bacteremia during the initial episode from a new infection or microbiological relapse after treatment.

To improve comparability across studies, recurrence should be defined using the timing of repeat positive cultures, organism identity, evidence of microbiological clearance, and duration of follow-up. Microbiological relapse, reinfection, persistent infection, and clinical treatment failure should be reported as distinct outcomes wherever possible (Huerta et al., 2018; Ranganath et al., 2025).

2.1.4.5 Mortality and causal attribution

Mortality is a major outcome in CLABSI research, but crude mortality among infected patients does not necessarily represent mortality directly attributable to infection. Patients requiring central venous access may already have severe underlying disease, malignancy, organ dysfunction, or prolonged critical illness, all of which can increase baseline mortality.

In a national inpatient database study of adults hospitalized with CLABSI in the United States between 2016 and 2020, Dix et al. (2024) reported an overall in-hospital mortality rate of 9.1%. The study also identified differences in mortality, length of stay, and costs across demographic groups and hospital characteristics. These findings indicate that outcomes vary according to patient and healthcare-system factors, although the database design cannot fully establish the causes of these disparities.

Tao et al. (2026) likewise reported higher in-hospital mortality in the CLABSI group than in matched patients without CLABSI. Taken together, these studies support an association between CLABSI and adverse outcomes, but estimates should not automatically be interpreted as infection-attributable mortality. Future studies should specify the mortality time horizon, comparison group, adjustment variables, and methods used to account for confounding and the timing of infection (Dix et al., 2024; Tao et al., 2026).

2.1.4.6 Healtcare costs

The economic burden of CLABSI may include antimicrobial therapy, laboratory investigations, additional procedures, catheter replacement, and prolonged hospitalization. In their national inpatient database analysis, Dix et al. (2024) reported a median hospital cost of US$44,810 among adult CLABSI hospitalizations in the United States. Costs also varied by demographic characteristics, hospital location and teaching status, and geographic region.

A hospital-wide matched case–control study by Tao et al. (2026) found that CLABSI was associated with higher direct medical costs, with an adjusted difference of US$13,962 between matched patients with and without infection. The study also found variation in the economic burden between clinical departments. These estimates should be interpreted in the context of the study setting, price year, costing methods, and local healthcare system rather than applied directly to other countries.

Economic evaluations should distinguish total costs among infected patients from incremental costs attributable to infection. Researchers should state the analytical perspective, price year, resource categories, and adjustment methods used. Such reporting is essential for comparing economic outcomes across clinical settings and evaluating the potential value of CLABSI prevention programmes (Dix et al., 2024; Tao et al., 2026).

2.2 Prognosis

Central line-associated bloodstream infection (CLABSI) is associated with substantial morbidity, prolonged hospitalization, increased healthcare costs, and an increased risk of mortality. The prognosis varies according to infection severity, underlying conditions, causative microorganisms, and the timeliness of diagnosis and treatment. Patients in intensive care units (ICUs), neonates, immunocompromised individuals, and patients with multiple comorbidities may be particularly vulnerable to adverse outcomes.

CLABSI can progress to sepsis, septic shock, and multiorgan dysfunction, particularly when appropriate antimicrobial therapy and source control are delayed. However, CLABSI does not invariably result in death, as outcomes depend on early recognition, appropriate antimicrobial treatment, and effective infection-control measures.

A systematic review and meta-analysis reported that CLABSI and catheter-related bloodstream infections were associated with higher odds of all-cause mortality (OR 3.19; 95% CI 2.44–4.16) and an increase in hospital length of stay of 16.14 days (95% CI 9.27–23.01) (Elangovan et al., 2024). These estimates should be interpreted cautiously because of heterogeneity across studies and potential confounding.

A retrospective cohort study reported a 30-day mortality rate of 18.8% among patients with CLABSI. Mortality was higher among patients requiring intensive care, inotropic support, or intubation, highlighting the importance of clinical severity and organ-support requirements in determining prognosis (Alotaibi et al., 2023).

Overall, CLABSI has a potentially serious prognosis, but outcomes vary considerably among patients. Prognostic estimates should distinguish all-cause mortality from infection-attributable mortality and account for baseline disease severity, concurrent infections, and differences in case definitions.

3 CONCLUSION

Central line-associated bloodstream infection remains an important healthcare-associated complication across diverse clinical settings. Its reported burden varies with patient characteristics, catheter exposure, clinical practices, healthcare resources, and surveillance methods. Evidence syntheses identify catheter duration, device characteristics, parenteral nutrition, illness severity, and comorbidities as relevant risk factors, although the independent contribution of these factors requires careful interpretation.

Prevention should integrate appropriate catheter selection, aseptic insertion, reliable maintenance, staff education, surveillance, and timely removal when access is no longer necessary. The effectiveness of these measures depends on consistent implementation and adaptation to local clinical circumstances. Progress in reducing CLABSI requires standardised definitions, valid exposure-adjusted incidence measures, stronger multicentre evidence, improved attribution of clinical outcomes, and sustained infection-prevention programmes. Completion of the planned literature search and full-text verification is necessary to establish the consistency and applicability of these findings across clinical settings.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

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