JOURNAL OF MICROBIOLOGY AND INFECTION
Jan - Jun 2026, VOL. 4, ISSUE 1, pp. 19-22
https://doi.org/10.61577/jmi.2026.100004

RESEAPRO JOURNALS

MINI REVIEW

OPEN ACCESS

Antimicrobial stewardship and Clostridioides difficile prevention in hospitalised patients: A mini review with implications for intensive care

J. Modi and Anju Bhasin

10X Accel, 10X Learning Academy, 111 Town Square Place, Suite 1201, Jersey City, New Jersey 07310, United States

ABSTRACT

Inappropriate antibiotic use can contribute to Antimicrobial Resistance (AMR) and increase the risk of Clostridioides Difficile Infection (CDI). Critically ill hospitalised patients are frequently exposed to broad-spectrum antibiotics for suspected or confirmed infections. This narrative review examines the relationship between antibiotic exposure, AMR, and CDI, and discusses prevention and management strategies with implications for intensive care. The evidence is organised into five themes: antibiotic optimisation and de-escalation, diagnostic stewardship, guideline-concordant CDI treatment, infection prevention, and recurrence prevention. Antimicrobial stewardship supports appropriate antibiotic selection, dosing, route, and duration, including narrowing or discontinuing treatment when clinically appropriate. Diagnostic testing must distinguish symptomatic infection from colonisation, and treatment recommendations must account for disease severity and recurrence. The reviewed evidence supports a coordinated prevention and management approach but does not establish the superiority of this exact five-component package. Because several sources concern general hospital or long-term care populations, their findings cannot be assumed to represent ICU-specific effects. Antimicrobial stewardship is an important component of reducing unnecessary antibiotic exposure and CDI risk, alongside appropriate treatment and infection-prevention measures.

KEYWORDS

Antibiotic overuse; Antimicrobial resistance; Clostridioides difficile infection; Antimicrobial stewardship; Antibiotic de-escalation

ARTICLE HISTORY

Received 02 April 2026;
Accepted 30 April 2026;
Published 06 May 2026

Definitions of Key Terms

Antibiotic overuse: Improper selection, dose or duration of antibiotics when they are not needed or when a different treatment would be more appropriate.

Antimicrobial resistance (AMR): The ability of microorganisms to withstand antimicrobial agents that would otherwise inhibit or kill them.

Clostridioides difficile infection (CDI): Symptomatic infection caused by toxigenic C. difficile, commonly following antibiotic-associated disruption of the intestinal microbiota.

Antimicrobial stewardship: A process of proper use of antibiotics that optimizes antibiotic selection, dosing, route, and duration, along with timely de-escalation when clinically appropriate to achieve the best clinical outcomes while minimizing resistance and adverse effects.

Antibiotic de-escalation: Narrowing the antimicrobial spectrum or reducing unnecessary agents in response to clinical and microbiological information. Antibiotics should be discontinued when infection is no longer supported; a route change alone does not constitute spectrum de-escalation.

CDI recurrence: The return of CDI after successful initial treatment

Infection prevention: Measures to prevent the transmission and spread of infectious organisms between patients, healthcare workers, and the environment.

Introduction

Antibiotics are valuable, potentially life-saving drugs, but they can also cause adverse effects. Inappropriate use promotes selection of antimicrobial resistance and can disrupt the intestinal microbiota, increasing susceptibility to CDI [1]. CDI involves proliferation of toxigenic C. difficile and toxin-mediated intestinal inflammation; antibiotic exposure is an important risk factor rather than a sufficient cause of infection [2].

Antibiotic use is particularly important in the ICU, where critically ill patients may require urgent empirical treatment, prolonged hospitalisation, and invasive procedures. Broad-spectrum antibiotics may be necessary before the causative organism is known. Treatment should subsequently be reassessed using clinical progress, microbiological findings, and the likelihood of infection; unnecessary broad-spectrum treatment should not continue solely because it was initially appropriate [1,3,4].

Antimicrobial stewardship programmes support appropriate antibiotic selection, dose, route, and duration, with reassessment as clinical and laboratory information becomes available [5,6]. Narrowing treatment when possible and discontinuing antibiotics when infection is no longer supported can reduce unnecessary exposure while maintaining effective care [3,4].

Despite the knowledge about the relationship between antibiotic exposure, AMR, and CDI, challenges remain in applying these principles consistently in hospitalized and critically ill patients. It is very hard to avoid unnecessary antibiotics exposure while also trying to provide treatment for serious infections. Due to this, developing a better understanding of how stewardship practices affect CDI is important for improving patient care and reducing preventable complications.

This narrative review examines antibiotic exposure, AMR, and CDI in hospitalised patients, with particular attention to implications for intensive care. It discusses antibiotic optimisation and de-escalation, appropriate diagnostic testing, CDI treatment, transmission prevention, and recurrence prevention. Evidence from non-ICU populations is identified as indirect support rather than proof of ICU-specific effectiveness.

Review question: How can antimicrobial stewardship and complementary prevention and management strategies

***Correspondence:** Mrs Anju Bhasin, 10X Accel, 10X Learning Academy, 111 Town Square Place, Suite 1201, Jersey City, New Jersey 07310, United States. e-mail: njny01@gmail.com

© 2026 The Author(s). Published by Reseapro Journals. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

reduce unnecessary antibiotic exposure and CDI risk in hospitalised patients, and what are the implications for intensive care?

Methods

This review synthesises published studies, evidence reviews, and clinical guidance concerning antibiotic exposure, antimicrobial stewardship, AMR, and CDI in healthcare settings. Search terms included "antibiotic overuse," "antimicrobial resistance," "Clostridioides difficile infection," "antimicrobial stewardship," "antibiotic de-escalation," "CDI recurrence," and "infection prevention." It is a thematic narrative synthesis, not a systematic review or meta-analysis.

The evidence was organised into five themes: antibiotic optimisation and clinically appropriate de-escalation, diagnostic stewardship, guideline-concordant CDI treatment, infection prevention and environmental cleaning, and recurrence prevention. These themes organise the discussion; they do not represent a newly validated clinical protocol.

Narrative synthesis

The reviewed evidence links antibiotic exposure and inappropriate prescribing with AMR and CDI risk, while supporting antimicrobial stewardship as part of prevention [1,5]. Guidelines also support appropriate diagnostic testing, CDI treatment, infection-control measures, and recurrence prevention [2,7]. These complementary approaches are discussed below. Their relative effectiveness, and the effect of combining all five specifically in ICU patients, were not directly compared in this review.

Antibiotic Optimization and De-escalation

Antibiotic optimisation involves selecting the indication, agent, spectrum, dose, route, and duration according to the patient's condition and suspected or confirmed infection [5]. In the ICU, empirical broad-spectrum therapy may be necessary initially. Once clinical and microbiological information becomes available, clinicians should reassess whether treatment can be narrowed, unnecessary agents removed, or antibiotics stopped if infection is no longer supported [3,4]. Identification of an organism does not automatically make de-escalation appropriate; susceptibility, infection site, clinical stability, and any ongoing need for broader coverage must be considered. Such reassessment reduces avoidable exposure without implying that undertreatment of serious infection is acceptable [5,8].

Shea et al. studied an antibiotic stewardship program at four different hospitals. The program reduced the use of certain antibiotics and was linked to lower rates of C. diff. The study shows that doctors need to review antibiotics when new test results are available and narrow or stop them when they are no longer needed [9].

CDC guidance identifies fluoroquinolones, carbapenems, and third- and fourth-generation cephalosporins as targets for assessing avoidable CDI-associated antibiotic exposure [2]. Kallen et al. evaluated fluoroquinolone restriction during a community-hospital CDI outbreak; its setting differs from ICU-specific care [10]. In a separate US state-level observational analysis, a 1% increase in reported stewardship Core Elements compliance was associated with a 0.3% decrease in CDI in 2016 relative to 2014 [11]. This association does not establish causation or quantify an individual ICU's expected benefit.

Diagnostic Stewardship

Diagnostic stewardship involves selecting and interpreting tests in the appropriate clinical context to avoid unnecessary testing and treatment. Some hospitalised patients carry C. difficile without symptomatic infection; a positive test alone therefore does not establish CDI. Testing should be directed by compatible symptoms and consideration of alternative causes of diarrhoea [2].

Patients with suspected CDI should be evaluated promptly and placed on appropriate contact precautions while assessment proceeds. Clinical findings and test results must be interpreted together to distinguish infection from colonisation. Repeat testing to demonstrate cure is not recommended when symptoms have resolved [2].

Diagnostic stewardship is also important for other infections in the ICU. For example doctors can collect cultures before starting antibiotics when it is safe to do so. These results can later help doctors figure out whether an antibiotic should be continued, changed, narrowed, or stopped.

Appropriate Treatment of CDI

The 2021 IDSA/SHEA focused update conditionally favours fidaxomicin over a standard vancomycin course for an initial nonfulminant CDI episode, subject to available resources; vancomycin remains an acceptable alternative [7]. This preference does not extend to fulminant CDI. Fulminant disease, characterised by hypotension or shock, ileus, or megacolon, requires a vancomycin-based regimen, with adjunctive intravenous metronidazole and consideration of rectal vancomycin when indicated, rather than extrapolation from fidaxomicin trials.

Louie et al. enrolled 629 adults in a randomised trial comparing fidaxomicin with vancomycin. Initial clinical cure was noninferior with fidaxomicin. In the modified intention-to-treat analysis, recurrence occurred in 15.4% of fidaxomicin recipients versus 25.3% of vancomycin recipients (P = 0.005) [12]. These results support a recurrence benefit in the studied population; they do not establish faster recovery or ICU-specific effectiveness.

For recurrent CDI, the 2021 update favours fidaxomicin over standard-course vancomycin, while retaining vancomycin taper/pulse and other options according to recurrence history. The update also suggested adjunctive bezlotoxumab for selected patients, with caution in those with congestive heart failure [7]. However, the American Society of Health-System Pharmacists lists bezlotoxumab injection as discontinued in the United States [12]. Its historical guideline recommendation must therefore be distinguished from current US availability. These adult recommendations are not supported exclusively by ICU-specific evidence.

Infection Prevention and Environmental Cleaning

The fourth approach is preventing CDI from spreading inside the hospital.

CDI is hard to control due to the fact that it produces spores. These spores can survive on many surfaces and spread throughout the hospital.

Sanitizing the environment of patients with C. diff is an important part of infection prevention. This is because C. diff spores can contaminate healthcare surfaces. Research on environmental cleaning has shown some benefits, but the

© 2026 Reseapro Journals
https://doi.org/10.61577/jmi.2026.100004

evidence is mixed. Chau et al. conducted a review and meta-analysis of 10 studies examining environmental cleaning bundles in hospitals and long-term care settings [13]. The review found that cleaning bundles significantly improved the thoroughness of environmental cleaning and reduced the proportion of rooms with positive CDI cultures; however, the review did not find a significant reduction in the incidence of CDI, and the evidence for this outcome was considered very low quality [13]. Another review indicated that most studies found a decrease in C. diff infection rates at the facility level when performing decontamination practices, although the overall evidence level was rated low, and certain flaws existed within the approach [14]. Therefore, environmental cleaning should not be considered the sole solution to the problem,but must occur alongside other infection control measures like proper hygiene procedures, using contacts precautions, patient isolation, and appropriate antimicrobial management [13,14].

Hand hygiene is important in preventing CDI transmission. A randomised study compared soap-and-water handwashing with alcohol hand rub for removing C. difficile spores from patients' hands [15]. Soap and water can physically remove spores, whereas alcohol-based hand rub does not reliably inactivate them. Hand hygiene must accompany gloves, contact precautions, and appropriate environmental cleaning rather than replace these measures [2].

Preventing CDI From Coming Back

Recurrence is a major problem after CDI treatment. Its frequency varies with the patient population, treatment, and follow-up. For example, Louie et al. reported four-week recurrence of 15.4% with fidaxomicin and 25.3% with vancomycin in the modified intention-to-treat analysis. These trial-specific figures should not be treated as a universal recurrence rate for ICU patients [12].

An appropriate initial treatment can improve sustained response. Fidaxomicin has evidence supporting lower recurrence than standard-course vancomycin, and the 2021 IDSA/SHEA update favours it for appropriate initial or recurrent nonfulminant CDI, subject to resources and the patient's circumstances [7].

Microbiota-directed approaches aim to restore intestinal colonisation resistance after antibiotic-associated disruption. The 2021 IDSA/SHEA update retains faecal microbiota transplantation as an option for multiple recurrences after failure of appropriate antibiotic treatment, with donor and specimen screening and attention to safety alerts [7]. This does not imply routine use after a first episode or established suitability for every critically ill patient.

Avoiding unnecessary antibiotics after recovery is another important stewardship measure, because further exposure can again disrupt the intestinal microbiota. Subsequent antibiotic treatment should be reserved for a supported indication and reassessed for spectrum and duration [5,8].

Discussion

The reviewed evidence supports antimicrobial stewardship alongside diagnostic, treatment, and infection-prevention measures. Evidence for reduced unnecessary antibiotic use and CDI risk should be distinguished from evidence about treatment of established CDI and recurrence. Fidaxomicin has trial evidence for lower recurrence than standard-course vancomycin, whereas environmental cleaning studies have heterogeneous findings. This review did not compare the relative effectiveness of the five themes or establish that the exact five-component package outperforms individual strategies.

A coordinated approach is clinically reasonable, but ICU-specific effectiveness cannot be inferred directly from general hospital, state-level, or long-term care evidence. Observational associations, trial results, and guideline recommendations have different evidentiary roles. Implementation in intensive care should account for disease severity, microbiological findings, local resistance patterns, and patient stability, rather than assuming uniform benefits across settings.

Stewardship recommendation

In the ICU, antibiotic prescriptions should be reassessed as clinical and microbiological information becomes available [3,4].

The healthcare team should discontinue antibiotics when infection is no longer supported, narrow the spectrum when clinically appropriate, and use the shortest effective duration for the specific infection. Initial broad-spectrum treatment for a serious suspected infection must not be delayed or inadequately narrowed solely to reduce CDI risk. Stewardship should be coordinated with diagnostic and infection-prevention practices [5,8].

Strengths

A strength of this narrative review is its use of US institutional guidance from the CDC, AHRQ, and IDSA/SHEA alongside published clinical studies. It connects antimicrobial stewardship with both AMR and CDI prevention. However, reliance on US guidance is a contextual feature rather than evidence of superior applicability to every healthcare system.

Limitations

Several limitations affect interpretation. The evidence includes non-ICU hospital and long-term care populations, limiting direct inference to intensive care. Some studies are observational and cannot establish causation. Environmental cleaning studies are heterogeneous, and reductions in contamination do not necessarily establish reductions in clinical CDI. As a narrative review without a reproducible search strategy or formal risk-of-bias assessment, this synthesis may be affected by selection bias and does not establish comprehensive coverage of literature through 2026. The five themes are an organisational framework rather than a validated intervention bundle. Guidance must also be interpreted in light of disease severity and current treatment availability.

Conclusion

Antimicrobial stewardship supports appropriate antibiotic selection, dosing, route, and duration in hospitalised patients. For intensive care, the objective is to maintain timely and effective treatment of serious infection while reducing avoidable antibiotic exposure through repeated reassessment. Appropriate CDI testing, severity-specific treatment, contact precautions, environmental cleaning, and recurrence prevention complement stewardship.

The reviewed literature supports these principles, but does not quantify their combined effect specifically in ICU populations or establish the superiority of the proposed

© 2026 Reseapro Journals
https://doi.org/10.61577/jmi.2026.100004

five-theme approach. ICU-specific evaluations are needed to clarify implementation and outcomes.

Author Contributions

Research planning and study design: J.M., A.B.; Literature synthesis: J.M., A.B.; Manuscript development: J.M., A.B.; Critical revision and technical assistance: J.M., A.B.; Project leadership & supervision: A.B. All authors have reviewed, approved the final manuscript, and agree to be accountable for the work.

Funding

The authors received no specific external grants from any funding agency in the public, commercial, or not-for-profit sectors for this review.

Conflict of Interest

The authors declare no competing financial, personal, or professional interests.

Ethics Declaration

Not Applicable

References

1. Baur D, Gladstone BP, Burkert F, Carrara E, Foschi F, Döbele S, et al.. Effect of antibiotic stewardship on the incidence of infection and colonisation with antibiotic-resistant bacteria and Clostridium difficile infection: a systematic review and meta-analysis. The Lancet Infectious Diseases. 2017;17(9):990–1001. https://doi.org/10.1016/S1473-3099(17)30325-0
2. Centers for Disease Control and Prevention. Centers for Disease Control and Prevention. (n.d.). Clinical guidance for CDI infection prevention in acute care facilities. 2026.
3. Agency for Healthcare Research Quality. Four moments of antibiotic decision making. . 2019.
4. Agency for Healthcare Research Quality. Toolkit to improve antibiotic use in acute care hospitals. . 2019.
5. Barlam TF, Cosgrove SE, Abbo LM, MacDougall C, Schuetz AN, Septimus EJ, et al.. Implementing an antibiotic stewardship program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. Clin Infect Dis. 2016;62(10):e51–e77. https://doi.org/10.1093/cid/ciw118
6. Pollack LA, Srinivasan A. Core elements of hospital antibiotic stewardship programs from the Centers for Disease Control and Prevention. Clin Infect Dis. 2014;59(suppl_3):S97–S100. https://doi.org/10.1093/cid/ciu542
7. Johnson S, Lavergne V, Skinner AM, Gonzales-Luna AJ, Garey KW, Kelly CP, et al.. Clinical practice guidelines by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA): 2021 focused update guidelines on management of Clostridioides difficile infection in adults. Clin Infect Dis. 2021;73(5):e1029–e1044. https://doi.org/10.1093/cid/ciab549
8. Centers for Disease Control, Prevention. Core elements of hospital antibiotic stewardship programs. . 2019.
9. Shea KM, Hobbs ALV, Jaso TC, Bissett JD, Cruz CM, Douglass ET, et al.. Effect of a health care system respiratory fluoroquinolone restriction program to alter utilization and impact rates of Clostridium difficile infection. Antimicrob Agents Chemother. 2017;61(6):e00125-17. https://doi.org/10.1128/aac.00125-17
10. Kallen AJ, Thompson A, Ristaino P, Chapman L, Nicholson A, Sim B-T, et al.. Complete restriction of fluoroquinolone use to control an outbreak of Clostridium difficile infection at a community hospital. Infect Control Hosp Epidemiol. 2009;30(3):264–272. https://doi.org/10.1086/595694
11. Garcia Reeves AB, Lewis JW, Trogdon JG, Stearns SC, Weber DJ, Weinberger M. Association between statewide adoption of the CDC's Core Elements of Hospital Antimicrobial Stewardship Programs and rates of methicillin-resistant Staphylococcus aureus bacteremia and Clostridioides difficile infection in the United States. Infect Control Hosp Epidemiol. 2020;41(4):430–437. https://doi.org/10.1017/ice.2019.352
12. Louie TJ, Miller MA, Mullane KM, Weiss K, Lentnek A, Golan Y, et al.. Fidaxomicin versus vancomycin for Clostridium difficile infection. N Engl J Med. 2011;364(5):422–431. https://doi.org/10.1056/nejmoa0910812
13. Chau JPC, Liu X, Lo SHS, Chien WT, Wan X. Effects of environmental cleaning bundles on reducing healthcare-associated Clostridioides difficile infection: A systematic review and meta-analysis. Hosp Infect. 2020;106(4):734–744. https://doi.org/10.1016/j.jhin.2020.08.019
14. Schoyer E, Hall K. Environmental cleaning and decontamination to prevent Clostridioides difficile infection in health care settings: A systematic review. J Patient Saf. 2020;16(3S Suppl 1):S12–S15. https://doi.org/10.1097/pts.0000000000000749
15. Kundrapu S, Sunkesula V, Jury I, Deshpande A, Donskey CJ. A randomized trial of soap and water hand wash versus alcohol hand rub for removal of Clostridium difficile spores from hands of patients. Infect Control Hosp Epidemiol. 2014;35(2):204–206. https://doi.org/10.1086/674859

© 2026 Reseapro Journals

https://doi.org/10.61577/jmi.2026.100004