

CADTH Reference List

Antimicrobial Stewardship Programs

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Key Message

Six evidence-based guidelines and 1 systematic review of evidence-based guidelines were identified regarding antimicrobial stewardship programs.

Research Question

What are the evidence-based guidelines regarding antimicrobial stewardship programs?

Methods

Literature Search Methods

A limited literature search was conducted by an information specialist on key resources, including MEDLINE, the Cochrane Database of Systematic Reviews, the international HTA database, the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search strategy comprised both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were antimicrobials, stewardship, and hospitals and long-term care settings. Search filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, or network meta-analyses and guidelines. When possible, retrieval was limited to the human population. The search was also limited to English-language documents published between January 1, 2016, and July 23, 2021. Internet links were provided, if available.

Selection Criteria and Summary Methods

One reviewer screened literature search results (titles and abstracts) and selected publications according to the inclusion criteria presented in Table 1. Full texts of study publications were not reviewed. The Overall Summary of Findings was based on information available in the abstracts of selected publications. Open-access, full-text versions of evidence-based guidelines were reviewed if abstracts were not available, and relevant recommendations were summarized.

Results

Seven relevant references were identified for this report.¹⁻⁷ Six evidence-based guidelines¹⁻⁶ and 1 systematic review of evidence-based guidelines⁷ were identified regarding antimicrobial stewardship programs (ASPs).

Additional references of potential interest that did not meet the inclusion criteria but provided guidance and recommendations or insights on the development and implementation of ASPs,

Table 1: Selection Criteria

Criteria	Description
Setting	Acute-care hospitals or long-term care settings including multi-site health care systems or networks.
Intervention	ASPs
Comparator	Not Applicable
Outcomes	Recommendations regarding best practices for the development and implementation of ASPs (e.g., prescribing practices, staff education, formulary restrictions, team composition for ASP, elements of an ASP; audit and feedback within ASPs)
Study designs	Evidence-based guidelines

ASP = antimicrobial stewardship program.

are summarized in Appendix 1. Additional references of potential interest that did not meet the inclusion criteria are provided in Appendix 2.

Overall Summary of Findings

Six evidence-based guidelines¹⁻⁶ and 1 systematic review of evidence-based guidelines⁷ were identified regarding ASPs. One of the identified guidelines¹ provided specific recommendations for de-escalation in the intensive care unit, the guideline from the Association of Medical Microbiology and Infectious Disease Canada² focused on minimizing antimicrobial use, and 4 of the identified guidelines³⁻⁶ provided overarching recommendations for ASPs. Some general themes that emerged were the inclusion of a multidisciplinary team,⁴ incorporating de-escalation strategies,^{1,4} and the implementation of audit and feedback programs.³⁻⁶ The systematic review of clinical practice guidelines⁷ identified 5 guidelines to inform recommendations, concluding that prior authorization and/or restriction should be considered essential for the development of a hospital-based ASP. The full text was unavailable so a detailed summary could not be provided.⁷ A summary of guideline recommendations can be found in Table 2. Links are provided in the reference list to the full-text versions of the guidelines.

Table 2: Summary of Guidelines for Antimicrobial Stewardship Programs

Guideline Development Group (year)	Summary of guideline recommendations
Lakbar et al. (2020) ¹	For short treatment periods (5 to 7 days), if antibiotic susceptibility is known by day 3, changing antibiotics should be considered. For treatments longer than 5 to 7 days, antimicrobial de-escalation is recommended (see p. 3093).
Association of Medical Microbiology and Infectious Disease Canada (2018) ²	The recommendation for antimicrobial stewardship, is to strategize to avoid unnecessary antibiotic use (see p. 81).
Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America (2016) ³	<p>Specific recommendations for implementing an antibiotic stewardship program can be found in the full text (see p. 1197–1201). Recommendations include, but are not limited to, those for:</p> <ul style="list-style-type: none"> • preauthorization • dosing strategies • educational materials • adapting strategies to the local context • the use of computerized clinical decision support.
German Society for Infectious Diseases (2016) ⁴	<p>There are many recommendations in this guideline; specific recommendations can be found in the full text, including recommendations for the following areas:</p> <ul style="list-style-type: none"> • Requirements for an ABS program <ul style="list-style-type: none"> ◦ the makeup and role of a multidisciplinary ABS expert team within a hospital (see p. 398) ◦ the implementation of a surveillance system and data to be collected (see p. 398–399). • Core strategies for an ABS program <ul style="list-style-type: none"> ◦ the implementation of local treatment guidelines, a hospital anti-infective formulary, formulary restrictions, and approval requirements for antimicrobials (see p. 399) ◦ the design and implementation of education, training, and information for all staff (see p. 400) ◦ the completion of proactive audits of anti-infective use (see p. 400) ◦ the use of quality indicators (see p. 400). • Supplemental ABS strategies <ul style="list-style-type: none"> ◦ de-escalation strategies (see p. 400–401) ◦ strategies focused on the duration of treatment, dose optimization, and switching antimicrobials (see p. 401–402) ◦ communicating microbiology results and the management of patients with multidrug-resistant micro-organisms (see p. 402) ◦ strategies for the use of computerized information technology (see p. 402–403).

Guideline Development Group (year)	Summary of guideline recommendations
<p>National Institute for Health and Care Excellence (2016)⁵</p>	<p>Recommendations for antimicrobial prescribing:</p> <ul style="list-style-type: none"> • Advice about self-management and adverse consequences of overusing antimicrobials should be provided to people with self-limiting conditions (see p. 9). • If it is unknown whether a condition is self-limiting, a back-up antimicrobial can be used (see p. 9). • Information regarding the clinical indication, dose, and duration of antimicrobial treatment should be documented in a patient’s clinical record (see p. 9). • When an antimicrobial is prescribed in the hospital, a microbiological sample should be taken and treatment reviewed when the results are available (see p. 9). • Data monitoring and feedback should be completed on prescribing practices at the prescriber, team, organization, and commissioner level(see p. 9).
<p>Pan-Canadian Public Health Network (2016)⁶</p>	<p>There are many recommendations in this guideline; specific recommendations can be found in the full text, including recommendations for the following areas:</p> <ul style="list-style-type: none"> • Interventions: education, awareness, and tools for prescribers and users: <ul style="list-style-type: none"> ◦ Education and awareness activities are provided for both the user and provider context (see p. 32). ◦ Materials, training in infectious disease prevention and control, and related tools be improved (see p. 32). • Monitoring and evaluation: <ul style="list-style-type: none"> ◦ Evidence-based audit and feedback tools and mechanisms be developed and implemented (see p. 33). ◦ Guidelines for prescribers are evaluated, adapted, and implemented at both provincial and regional levels. Ongoing monitoring and evaluation of these guidelines should be completed by the provincial, territorial, and regional jurisdictions (see p. 33). ◦ Benchmarks should be established for type of infections and populations at greater risk for infection (see p. 33). ◦ Federal, provincial, and territorial governments collaboratively establish performance measurement targets for hospital and community settings (see p. 33). ◦ Evaluations of stewardship programs be conducted and made public to allow dissemination of best practices (see p. 33). • Future research: knowledge creation, translation, and mobilization: <ul style="list-style-type: none"> ◦ Further evidence on the prescription profiles of all prescribing professionals should be gathered, analyzed, and mobilized by federal, provincial, and territorial jurisdictions governments (see p. 34).

ABS = antibiotic stewardship; ASP = antimicrobial stewardship program; ICU = intensive care unit; NICE = National Institute of Clinical Excellence; NICU = neonatal intensive care unit.

References

Guidelines and Recommendations

1. Lakbar I, De Waele JJ, Tabah A, Einav S, Martin-Loeches I, Leone M. Antimicrobial de-escalation in the ICU: from recommendations to level of evidence. *Adv Ther*. 2020 07;37(7):3083-3096. [PubMed](#)
2. Loo VG, Davis I, Embil J, et al. Association of Medical Microbiology and Infectious Disease Canada treatment practice guidelines for *Clostridium difficile* infection. *Official Journal of the Association of Medical Microbiology and Infectious Disease Canada*. 2018;3(2):71-92. <https://www.ammi.ca/Content/AMMI%20Canada%20treatment%20practice%20guidelines%20for%20Clostridium%20difficile%20infection.pdf>. Accessed 2021 Aug 03.
See: Recommendations for Antimicrobial Stewardship and *Clostridium Difficile* Infection (p. 81)
3. Barlam TF, Cosgrove SE, Abbo LM, et al. Executive Summary: 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 05 15;62(10):1197-1202. [PubMed](#)
4. de With K, Allerberger F, Amann S, et al. Strategies to enhance rational use of antibiotics in hospital: a guideline by the German Society for Infectious Diseases. *Infection*. 2016 Jun;44(3):395-439. [PubMed](#)
5. National Institute for Health and Care Excellence. Antimicrobial stewardship (*NICE quality standard QS121*) 2016; <https://www.nice.org.uk/guidance/qs121/resources/antimicrobial-stewardship-pdf-75545353537477>. Accessed 2021 Aug 03.
See: List of Quality Statements (p. 9)
6. The Communicable and Infectious Disease Steering Committee Task Group on Antimicrobial Use Stewardship. Antimicrobial stewardship. Ottawa (ON): Pan-Canadian Public Health Network; 2016: <http://www.phn-rsp.ca/pubs/anstew-gestan/index-eng.php>. Accessed 2021 Aug 03.
See: Recommendations (p. 30–34)

Systematic Review of Guidelines

7. Rennert-May E, Chew DS, Conly J, et al. Clinical practice guidelines for creating an acute care hospital-based antimicrobial stewardship program: A systematic review. *Am J Infect Control*. 2019 08;47(8):979-993. [PubMed](#)

Appendix 1: Summary of References for the Development and Implementation of Antimicrobial Stewardship Programs in Acute-Care or Long-Term Care Settings

Note that this appendix has not been copy-edited.

Four clinical practice guidelines,⁸⁻¹¹ 4 consensus documents,¹²⁻¹⁵ 2 policy documents^{16,17} and 4 other resources¹⁸⁻²¹ were identified regarding the development and implementation of ASPs; these resources had unclear or incompletely reported methods and hence were placed in the appendix.

Across the identified references, a few common themes emerged. Primarily, to ensure support and success of an ASP, it is important to garner support and involvement from hospital leadership.^{8-12,14} Furthermore, the implementation of a multidisciplinary team is important to not only have a variety of expertise, but also to aid in the implementation of the strategy throughout the hospital.^{10,12,14} Given that different hospitals have different priorities, capacities, and specialties onsite, it is important to individualize all components of the ASP to the local context.^{8,10,11,15} Some specific techniques identified in the literature to adapt ASPs to a local context include allowing prescribing doctors to seek authorization for the use of antimicrobials within 48 to 72 hours instead of solely preauthorization,^{8,10} using telemedicine to confer with offsite antimicrobial specialists,^{8,11} and developing tools such as checklists or pocket reference cards to ease uptake of guidelines.^{8,10}

A detailed summary of the literature identified for the development and implementation of ASPs, where access to a full text was available, can be found in Tables 3, Table 4, and Table 5.

Table 3: Summary of Guidelines for the Development and Implementation of Antimicrobial Stewardship Programs

Guideline Development Group (year)	Clinical Practice Guidelines and Recommendations
Alberta Health Services (2021)⁸	<p>Given the large number of recommendations in this guideline, specific recommendations can be found in the full text. Recommendations for the following areas can be found in the guideline:</p> <ul style="list-style-type: none"> • The implementation of prospective audits and feedback (see p. 9 to11) • Determining formulary restrictions and the use of preauthorization (see p. 11) • Education (see p. 12) <ul style="list-style-type: none"> ◦ For example, the implementation of on call Infectious Diseases physicians available for phone consultation and pocket reference cards on the guidelines of different conditions (see p. 12) • How to streamline and shorten the duration of therapy (see p. 13) • Dose optimization (see p. 14) • Microbiology laboratory practices (see p. 15) • Monitoring and antibiograms (see p. 16)

Guideline Development Group (year)	Clinical Practice Guidelines and Recommendations
<p>CDC (2019)⁹</p>	<p>The CDC recommends the following 7 core elements for all hospitals, regardless of size:</p> <ul style="list-style-type: none"> • Hospital Leadership Commitment • Accountability • Pharmacy Expertise • Action • Tracking • Reporting • Education <p>Further details can be found in the guideline.</p>
<p>Pan American Health Organization (2018)¹⁰</p>	<p>Given the large number of recommendations in this guideline, specific recommendations can be found in the full text. Recommendations for the following areas can be found in the guideline:</p> <ul style="list-style-type: none"> • Key components for resource-limited setting (see p. 23) • Core members of an ASP team (see p. 24 to 25) • Supporting members for the team (see p. 28 to 29) • Prescription-based strategies for hospital ASPs (see p. 30 to 36) • Information technology in ASPs (see p. 46 to 48) • Monitoring and evaluation (see p. 48 to 54)
<p>CDC (2017)¹¹</p>	<p>The CDC recommends 6 core elements for ASPs in small and critical access hospitals:</p> <ul style="list-style-type: none"> • Leadership Commitment/Accountability (see p. 3 to 4) <ul style="list-style-type: none"> ◦ Examples of some successful strategies: remote consultations with experts in antibiotic stewardships and enrolling in multi-hospital collaborative efforts • Drug Expertise (see p. 4) • Action (see p. 5) • Tracking (see p. 9) • Reporting (see p. 10) • Education (see p. 11) <p>Further details can be found in the guideline.</p>

ASP = antimicrobial stewardship program; CDC = Centers for Disease Control and Prevention.

Table 4: Summary of Consensus Documents for the Development and Implementation of Antimicrobial Stewardship Programs

Author (year)	Location/Source	Results and Author Conclusions
<p>Soriano et al. (2020)¹²</p>	<p>112 European experts from: Italy, Greece, Spain, Portugal, Russia, Romania, Germany, France, Austria, Poland, and Bulgaria.</p>	<p>The authors had complete agreement for the following main principles of an AMS: section, dosage and duration of antibiotic therapy; implementation of local and national guidelines; monitoring of antimicrobial use and resistance rates; implementation of fast microbiological diagnostic testing; implementation of clinical decision support systems; prevention of community and hospital-acquired infections; and limitation of antibiotic use.¹² The authors reported that a lack of a dedicated AMS team, commitment of hospital administration, of ID specialists in small hospitals and a multidisciplinary team, and limited economic resources were the main barriers.¹² Furthermore, awareness and lack of dedicated tools were identified as a key unmet need.¹²</p>

Author (year)	Location/Source	Results and Author Conclusions
Tabah et al. (2020) ¹³	16 international experts.	Full text unavailable.
Pulcini et al. (2019) ¹⁴	15 experts from North America, South America, Europe, Africa, Asia, and Australia.	The authors identified 4 core elements of an AMS: senior hospital management leadership toward AMS, accountability and responsibilities, available expertise on infection management, education and practical training, other actions, monitoring and evaluation, and reporting and feedback. ¹⁴ The authors also provided a detailed checklist for each of the core elements that could be relevant to hospital AMS programs worldwide.
Ten Oever et al. (2018) ¹⁵	21 stewardship teams from acute-care Dutch hospitals.	The authors identified the following recommendation: <ul style="list-style-type: none"> • The human resources hours needed each year are dependent on hospital size and number of stewardship objectives monitored.

AMS = antimicrobial stewardship.

Table 5: Summary of Policy Statements for the Development and Implementation of Antimicrobial Stewardship Programs

Author (year)	Location	Policy statements
Gerber et al. (2021) ¹⁶	NR	Full text unavailable.
Northern Health (2021) ¹⁷	British Columbia	Audit and Feedback Policy: “Clinical pharmacists with support from the Antimicrobial Stewardship (AMS) Program Coordinator will review and assess all orders for antimicrobials prescribed to patients admitted to Northern Health (NH) facilities or seen through the Community IV programs, and provide recommendations to the most responsible prescriber (MRP) for optimization when necessary. Clinical pharmacists may require advice from the Medical Lead for AMS who will be contacted ad hoc to review patient cases as part of the medical lead responsibilities and provide recommendations directly to the MRP” (p. 1)

AMS = antimicrobial stewardship; MRP = most responsible prescriber; NH = Northern Health; NR = not reported.

Clinical Practice Guidelines and Recommendations

Systematic Methodology Not Specified

- Hoang H, Saxinger L. Antimicrobial stewardship manual. Edmonton (AB): Alberta Health Services; 2021; <https://www.albertahealthservices.ca/assets/info/hp/as/if-hp-antimicrobial-stewardship-manual.pdf>. Accessed 2021 Aug 03.
See: Section F – Antimicrobial Stewardship Strategies and Guidance Documents
- Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs. 2019; <https://www.cdc.gov/antibiotic-use/core-elements/hospital.html>. Accessed 2021 Aug 03.
- Recommendations for implementing antimicrobial stewardship programs in Latin America and the Caribbean: manual for public health decision-makers. Washington (DC): Pan American Health Organization; 2018; <https://iris.paho.org/handle/10665.2/49645>. Accessed 2021 Aug 03.
See: Part 2 – Antimicrobial Stewardship Programs in Hospitals – Implementation (p. 21–55)
- Centers for Disease Control and Prevention. Implementation of antibiotic stewardship core elements at small and critical access hospitals. 2017; <https://www.cdc.gov/antibiotic-use/core-elements/small-critical.html>. Accessed 2021 Aug 03.

Consensus Documents

- Soriano A, Stefani S, Pletz MW, Menichetti F, Italian Group for Antimicrobial Stewardship (GISA). Antimicrobial stewardship in patients with acute bacterial skin and skin-structure infections: An international Delphi consensus. *J Glob Antimicrob Resist*. 2020 09;22:296-301. [PubMed](#)

13. Tabah A, Bassetti M, Kollef MH, et al. Antimicrobial de-escalation in critically ill patients: a position statement from a task force of the European Society of Intensive Care Medicine (ESICM) and European Society of Clinical Microbiology and Infectious Diseases (ESCMID) Critically Ill Patients Study Group (ESGCIP). *Intensive Care Med.* 2020 02;46(2):245-265. [PubMed](#)
14. Pulcini C, Binda F, Lamkang AS, et al. Developing core elements and checklist items for global hospital antimicrobial stewardship programmes: a consensus approach. *Clin Microbiol Infect.* 2019 Jan;25(1):20-25. [PubMed](#)
15. Ten Oever J, Harmsen M, Schouten J, et al. Human resources required for antimicrobial stewardship teams: a Dutch consensus report. *Clin Microbiol Infect.* 2018 Dec;24(12):1273-1279. [PubMed](#)

Policy Documents

16. Gerber JS, Jackson MA, Tamma PD, Zaoutis TE, AAP Committee on Infectious Diseases and Pediatric Infectious Diseases Society. Policy Statement: antibiotic stewardship in pediatrics. *J Pediatric Infect Dis Soc.* 2021 May 28;10(5):641-649. [PubMed](#)
17. Northern Health. Antimicrobial stewardship program. 2021; <https://physicians.northernhealth.ca/physician-resources/clinical-resources/antimicrobial-stewardship-program#about>. Accessed 2021 Aug 03.
See: Clinical Practice Standards

Additional References

18. Public Health Ontario. Antimicrobial stewardship. 2021; <https://www.publichealthontario.ca/en/health-topics/antimicrobial-stewardship>. Accessed 2021 Aug 03.
19. Goff DA, Kullar R, Bauer KA, File TM Jr. Eight habits of highly effective antimicrobial stewardship programs to meet the Joint Commission Standards for Hospitals. *Clin Infect Dis.* 2017 04 15;64(8):1134-1139. [PubMed](#)
20. Agency for Healthcare Research and Quality (AHRQ). Toolkit 1. Start an antimicrobial stewardship program. 2016; <https://www.ahrq.gov/nhguide/toolkits/implement-monitor-sustain-program/toolkit1-start-program.html>. Accessed 2021 Aug 03.
See: What Is the Start an Antimicrobial Stewardship Program Toolkit?
21. Goldstein EJC, Goff DA, Reeve W, et al. Approaches to modifying the behavior of clinicians who are noncompliant with antimicrobial stewardship program guidelines. *Clin Infect Dis.* 2016 08 15;63(4):532-538. [PubMed](#)

Appendix 2: References of Potential Interest

Note that this appendix has not been copy-edited.

Previous CADTH Reports

Outside of Search Time Range

22. Antimicrobial stewardship programs in acute and long-term care: guidelines. (*CADTH rapid response report: summary of abstracts*). Ottawa (ON): CADTH; 2012: <https://www.cadth.ca/media/pdf/htis/nov-2012/RB0540%20Antimicrobial%20Stewardship%20Programs%20Final.pdf>. Accessed 2021 Aug 03.

Guidelines and Recommendations

Alternative Intervention

23. Seaton RA, Cooper L, Fairweather J, et al. Antibiotic use towards the end of life: development of good practice recommendations. *BMJ Support Palliat Care*. 2021 Jan 19;19:19. [PubMed](#)

Guideline for Training Health Care Staff

24. Schrier L, Hadjipanayis A, Del Torso S, Stiris T, Emonts M, Dornbusch HJ. European Antibiotic Awareness Day 2017: training the next generation of health care professionals in antibiotic stewardship. *Eur J Pediatr*. 2018 Feb;177(2):279-283. [PubMed](#)

Review Articles

25. Brink AJ, Richards G. Best practice: antibiotic decision-making in ICUs. *Curr Opin Crit Care*. 2020 10;26(5):478-488. [PubMed](#)
26. Rost LM, Nguyen MH, Clancy CJ, Shields RK, Wright ES. Discordance among antibiotic prescription guidelines reflects a lack of clear best practices. *Open Forum Infect Dis*. 2020 Dec 22;8(1):ofaa571. [PubMed](#)

Alternative Intervention

27. Michienzi SM, Ladak AF, Perez SE, Chastain DB. Antiretroviral stewardship: a review of published outcomes with recommendations for program implementation. *J Int Assoc Provid AIDS Care*. 2020 Jan-Dec;19:2325958219898457. [PubMed](#)

Additional References

28. Adre C, Jump RLP, Spires SS. Recommendations for improving antimicrobial stewardship in long-term care settings through collaboration. *Infect Dis Clin North Am*. 2020 03;34(1):129-143. [PubMed](#)
29. Levy Hara G, Kanj SS, Pagani L, et al. Ten key points for the appropriate use of antibiotics in hospitalised patients: a consensus from the Antimicrobial Stewardship and Resistance Working Groups of the International Society of Chemotherapy. *Int J Antimicrob Agents*. 2016 Sep;48(3):239-246. [PubMed](#)