Actionable Patient Safety Solutions™ (APSS™):
Antimicrobial Stewardship

How to use this guide

This APSS provides evidence-based resources and recommendations for antimicrobial stewardship for executives, leaders, clinicians, and performance improvement specialists. This document is intended to be used as a guide for healthcare organizations to examine their own workflows, identify practice gaps, and implement improvements. In it, you will find:

Best Practice Summary: A high level summary of evidence-based, clinical best practices. (page 2)

Executive Summary: Executives should understand the breadth of the problem and its clinical and financial implications. (page 2)

Leadership Checklist: This section is for senior leaders to understand common patient safety problems and their implications related to antimicrobial stewardship. Most preventable medical harm occurs due to system defects rather than individual mistakes. Leaders can use this checklist to assess whether best practices are being followed and whether action is needed in their organization around antimicrobial stewardship. (page 3)

Clinical Workflow: This section includes more specific information around antimicrobial stewardship across the continuum of care. Leaders should include the people doing the work in improving the work. This section outlines what should be happening on the frontline. Clinicians can use this section to inform leaders whether there are gaps and variations in current processes. This is presented as an infographic that can be used for display in a clinical area. (page 4)

Education for Patients and Family Members: This section outlines what frontline healthcare professionals should be teaching patients and family members about how antimicrobial stewardship undermines the most robust clinician recommendations. Clinicians can inform leaders whether there are gaps and variations in current educational processes. (page 6)

Performance Improvement Plan: If it has been determined that there are gaps in current processes, this section can be used by organizational teams to guide them through an improvement project. (page 7)

What We Know about Antimicrobial Stewardship: This section provides additional detailed information about antimicrobial stewardship. (page 9)

Resources: This section includes helpful links to free resources from other groups working to improve patient safety. (page 10)

Endnotes: This section includes the conflict of interest statement, workgroup member list, and references. (page 11)

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Patient Safety
MOVEMENT

Best Practice Summary

- ☐ Assess the patient's individual history and their antimicrobial use.
- ☐ Identify high risk patients through multifactorial risk assessment tools.
- ☐ Use diagnostic tests to determine pathogenic etiology and make treatment recommendations.
- ☐ Determine whether the patient's condition would be most appropriately treated with antibiotics.
- ☐ Discuss patient's expectations for their appointment to avoid disappointment if antibiotics are not prescribed.
- ☐ Inform public health officials if antibiotics are prescribed.
- ☐ Communicate effectively with patients about when and why antibiotics are used.
- ☐ Thoroughly review the type of antimicrobial the patient has received and explain the reasons for which that particular treatment option was chosen.
- ☐ Educate the patient on how to properly store and administer the antimicrobial.
- ☐ Educate the patient about preventing the spread of contagious pathogens, infection control, and secondary bacterial infections.
- ☐ Examine trends in antimicrobial use and other related process and outcome metrics.

Executive Summary

The Problem

It has been shown that 30% of antibiotic prescriptions (47 million) per year in the US alone are unnecessary and directly contribute to antibiotic resistance (Antibiotic Use, 2017; Fleming-Dutra et al., 2016). 700,000 deaths are the direct result of antimicrobial resistant infections and it is estimated that by 2050, there will be 10 million antibiotic resistance-related deaths globally, corresponding to a price of $100 trillion (WHO, 2019; Milani et al., 2019). In Europe, 25,000 annually die in Europe from multidrug-resistant bacterial infections, which also result in losses of at least €1.5 billion per year (Four Diagnostic Strategies, 2016). It has been estimated that a 30% reduction in broad spectrum antibiotics (which would contribute to a 5% decrease in antibiotic use overall) prescribed for patients in the hospital and upon discharge would be correlated with a nearly 30% decrease in Clostridioides difficile infection alone (Fridkin et al., 2014).

The Cost

Antimicrobial resistance is estimated to add $1,383 per patient, culminating in $2.2 billion in excess costs annually (Thorpe et al., 2018). When infections can no longer be treated with the first-line, typically inexpensive, antibiotics, more involved and costly treatments are often necessary. In addition, these treatments usually require longer hospitalization, which places the patient at even greater risk for infection (Antibiotic Resistance, 2020).

The Solution

Many healthcare organizations have successfully implemented and sustained improvements around antimicrobial stewardship. This document provides a blueprint that outlines the actionable steps organizations should take to successfully improve antimicrobial use and summarizes the available evidence-based practice protocols. This document is revised annually and is always available free of charge on our website.

Leadership Checklist

Use this checklist as a guide to determine whether current evidence-based guidelines are being followed in your organization:

Measure process and outcome metrics on an ongoing basis to identify areas for improvement.

- [ ] Measure and report antimicrobial use monthly (Days of therapy of antibiotics/ 1000 patient days).
- [ ] Note trends in areas with high broad-spectrum antibiotic use and high antibiotic resistance. Routinely reassess outcomes.

Establish an antimicrobial stewardship program and align with other organizational activities for greatest impact (CDC, 2021).

- [ ] Consider pros and cons of restrictive and prospective antimicrobial stewardship programs. See Appendix A.
- [ ] Identify goals of the committee, which may include:
    - [ ] Decreasing inappropriate use of antibiotics,
    - [ ] Identifying and reducing risks of developing, acquiring, and transmitting infections,
    - [ ] Reducing healthcare costs and toxicities with antimicrobials and inappropriate therapy,
    - [ ] Preventing adverse drug events,
    - [ ] Improving specific patient outcomes (e.g., reducing C. difficile rates).
- [ ] Publish facility-specific guidelines which include recommendations for diagnostic and testing approaches and common indications for antibiotic use.
- [ ] Clarify clinical indication for antibiotic use and ensure these guidelines are readily available for the frontline.
- [ ] Use Computerized Provider Order Entry (CPOE) with Clinical Decision Support (CDS) and computer-based surveillance software to provide real-time data at the point of care for Antimicrobial Stewardship Program initiatives.
- [ ] Develop and disseminate educational materials for judicious antibiotic prescription and align these educational activities with other related educational activities across the organization for optimal impact.
- [ ] Create pharmacy-driven protocols, which may include
    - [ ] Establish clinical stability criteria for changes from intravenous (IV) to oral (PO) antibiotic therapy.
    - [ ] Standardizing adjustment of antimicrobial dosage in cases of organ dysfunction.
    - [ ] Optimizing dose (pharmacokinetics/pharmacodynamics) to treat organisms with reduced susceptibility.
    - [ ] Implement time-sensitive automatic stops to orders for specific antibiotic prescriptions.
- [ ] Create microbiology lab-driven protocols, which may include
    - [ ] Implementing rapid diagnostics, such as Multiplex PCR or Matrix Assisted laser desorption/ ionization-time of flight (MALDI-TOF)

☐ Standardizing procalcitonin level measurement.

☐ Reporting minocycline susceptibility for Acinetobacter isolates.

☐ Establish audit and feedback measures.

☐ Ensure that leaders have a simple process to oversee antimicrobial stewardship improvement work while also considering how it aligns with other initiatives across the organization.

Involve patients and those on the frontline in improvement initiatives.

☐ Ensure frontline involvement in antimicrobial stewardship improvement activities. Maintain their engagement and remove barriers to progress.

☐ Involve patient advocates and members of the Patient and Family Advisory Council (PFAC) in identifying barriers to patient antibiotic adherence and proper storage and disposal.

☐ Ensure that antimicrobial stewardship protocols are embedded into clinical workflows, whether electronic or paper.

☐ Ensure there are enough staff to effectively manage necessary care.

☐ Educate frontline staff on antimicrobial stewardship initiatives and progress.

☐ Ensure adequate training and documentation of antimicrobial stewardship competencies and skills.

☐ Debrief on a regular basis to solicit team feedback about barriers to sustained compliance. Adjust the plan quickly and nimbly as needed.

☐ Hold staff accountable for providing the standard of care and reward success.

Clinical Workflow

1. INITIAL ASSESSMENT

- Understand patient complaints and history of infection, antimicrobial use, and C. difficile.
- Assess for signs of sepsis. See Sepsis APSS.

2. PRESCRIBING CONSIDERATIONS

- Avoid unnecessary and inappropriate treatment.
    - o Use a diagnostic test to support the decision to use antimicrobials and to escalate or deescalate treatment by examining the pathogen, patient's response to antimicrobial treatment(s), antimicrobial susceptibility, and resistance markers.
    - o Confirm viral, fungal, or bacterial etiology.
    - o "Rule out" bacterial infections to support a decision to not treat with antibiotics instead of pursuing a "rule in" method.

- o Help the patient understand why they are not receiving antibiotics, if applicable. Often, patients expect to receive some form of prescription and without communicating with patients, patients may leave dissatisfied.
- Identify high-risk patients using multifactorial risk assessment tools.
- Determine if public health officials should be informed.
  - o The United States CDC provides the "2020 National Notifiable Conditions" as an example for conditions to report. Each country will likely have separate but similar guidelines.

3. POST-PRESCRIBING

- Reiterate what antimicrobials were administered and why.
- Help the patient understand how to properly store and take the antimicrobials at home.
- Educate patients on infection control in preventing the spread of contagious pathogens.
- Educate patients on available vaccines for conditions that can contribute to secondary bacterial infections (influenza, pneumonia, etc.).

Education for Patients and Family Members

The outline below illustrates all of the information that should be conveyed to the patient and family members by someone on the care team in a consistent and understandable manner.

Explain why antibiotics are or are not needed. If antibiotics are indicated, a member of the healthcare team should explain why and the anticipated course of treatment. Additionally, the patient and family members should understand how to properly take and store the antibiotics. It is essential to convey the importance of taking the antibiotics exactly as indicated.

If antibiotics are not indicated, explain to the patient and family members or caregivers why. Often, patient satisfaction can be linked to prescription and if they do not receive a prescription, they may feel as though their care was inadequate unless they receive an explanation.

Additionally, family members and caregivers should know exactly when to call for help, where to go for help, and with whom they should speak. It is essential that patients and family members and caregivers understand that they should not be ashamed to ask any of their questions and that many patients in similar situations often have similar questions.

Instead of employing a directive conversation style, an active, engaging conversation should take place, leaving capacity for questions and repeat-back strategies. When patients and family members understand the signs and symptoms that could be indicative of a problem, they are able to serve as an extra set of eyes in order to elevate this concern as early as possible.

Describe what can be anticipated. If antimicrobials are indicated, explain what the patient can expect in terms of side effects, resolution of symptoms, and the duration of treatment,, assuming they take the antimicrobials as instructed.

By engaging in these conversations before a problem arises, family members and caregivers can be prepared in the circumstance of necessary treatment and will have an understanding of where to go to find out more information about their loved one's infection or condition.

Explain what is expected of them during their care. By giving patients and family members a "job" while they are in the hospital, they can be immersed fully in the routine care, can hold other team members accountable, can feel more confident voicing their concerns or opinions, and can serve as an extra set of informed and vigilant eyes to prevent deterioration and further infection. This team involvement can also reduce their anxiety by transforming concern into proactive action.

Patients and family members and caregivers can:

- Ask about antimicrobial resistance
- Understand what infection the antimicrobial agent will treat
- Understand how long the antimicrobials will be needed, how to properly take the antibiotics, and the side effects that may be experienced
- Disclose if they have recently taken other antimicrobials or have been in another healthcare facility recently
- Inquire about hospital protocols to prevent infection, especially C. diff and MRSA
- Stay updated on their flu and pneumonia vaccinations
- Accept that, sometimes, antimicrobials will not be needed
- Use antimicrobials only as directed by the prescriber
- Make sure to keep antimicrobials secure and do not share them

- Engage in conversations around current potential health conditions
- Ask for clarification of antimicrobials resistance protocols and trends at the healthcare facility
- Monitor for hand hygiene in all healthcare providers and visitors
- Watch for any signs of clinical deterioration

Performance Improvement Plan

Follow this checklist to improve performance and move your organization toward eliminating the harm and death associated with unplanned extubation:

☐ **Gather the right project team.** Be sure to involve the right people on the team. You'll want two teams: an oversight team that is broad in scope, has 10-15 members, and includes the executive sponsor to validate outcomes, remove barriers, and facilitate spread. The actual project team consists of 5-7 representatives who are most impacted by the process. Whether a discipline should be on the advisory team or the project team depends upon the needs of the organization. Patients and family members should be involved in all improvement projects, as there are many ways they can contribute to safer care.

> **Complete this Lean Improvement Activity:**
> Conduct a SIPOC analysis to understand the current state and scope of the problem. A SIPOC is a lean improvement tool that helps leaders to carefully consider everyone who may be touched by a process, and therefore, should have input on future process design.

RECOMMENDED ANTIMICROBIAL STEWARDSHIP IMPROVEMENT TEAM	
• Infection preventionists	• Sepsis improvement teams
• Pharmacists	• Primary care providers
• Information technologists	• Outpatient specialists
• Quality and safety specialists	• Emergency medicine providers
• Nurses	• Urgent care providers
• Providers	• Dentists
• Microbiologists	• Admitting and registration staff

Table 1: Understanding the necessary disciplines for an antimicrobial stewardship improvement team

☐ **Understand what is currently happening and why.** Reviewing objective data and trends is a good place to start to understand the current state, and teams should spend a good amount of time analyzing data (and validating the sources), but the most important action here is to go to the point of care and observe. Even if team members work in the area daily, examining existing processes from every angle is generally an eye-opening experience. The team should ask questions of the

> Create a process map once the workflows are well understood that illustrates each step and the best practice gaps the team has identified (IHI, 2015). Brainstorm with the advisory team to understand why the gaps exist, using whichever root cause analysis tool your organization is accustomed to (IHI, 2019). Review the map with the advisory team and invite the frontline to validate accuracy.

frontline during the observations that allow them to understand each step in the process and identify the people, supplies, or other resources needed to improve patient outcomes.

ANTIBIOTIC ADMINISTRATION PROCESSES TO CONSIDER ASSESSING

- Assessment of prior C. diff infection
- Assessment of prior antibiotics or recent hospitalization
- Review of antibiotic therapy 2-3 days after initiation based on the patient's clinical lab data
- Patient education
- Distinction between viral versus bacterial infections through diagnostic testing

Table 2: Consider assessing these processes to understand where the barriers contributing to overuse of antibiotics may be in your organization

☐ **Prioritize the gaps to be addressed and develop an action plan.** Consider the cost effectiveness, time, potential outcomes, and realistic possibilities of each gap identified. Determine which are priorities of focus for the organization. Be sure that the advisory team supports moving forward with the project plan so they can continue to remove barriers. Design an experiment to be trialed in one small area for a short period of time and create an action plan for implementation.

The action plan should include the following:

- Assess the ability of the culture to change and adopt appropriate strategies
- Revise policies and procedures
- Redesign forms and electronic record pages
- Clarify patient and family education sources and content
- Create a plan for changing documentation forms and systems
- Develop the communication plan
- Design the education plan
- Clarify how and when people will be held accountable

TYPICAL GAPS IDENTIFIED IN ANTIBIOTIC USE

- Pressure to prescribe antibiotics based on financial incentives
- Pressure to prescribe antibiotics based on patient satisfaction
- Antibiotic administration guidelines are updated and not communicated effectively
- Duration and frequency of use guidelines are not known or used upon prescribing.

- Antibiotics are not stored or disposed of properly.
- Antibiotics are overused in the virtual setting (Ray et al., 2019).
- Whether the infection is viral or bacterial is not known at the time of prescribing.
- Providers do not have an full understanding of the patient's previous antimicrobial use and infection history.

Table 3: By identifying the gaps in antibiotic use, organizations can tailor their project improvement efforts more effectively

☐ **Evaluate outcomes, celebrate wins, and adjust the plan when necessary.** Measure both process and outcome metrics. Outcome metrics include the rates outlined in the leadership checklist. Process metrics will depend upon the workflow you are trying to improve and are generally expressed in terms of compliance with workflow changes. Compare your outcomes against other related metrics your organization is tracking.

Read this paper from the Institute for Healthcare Improvement to understand how small local steps

Routinely review all metrics and trends with both the advisory and project teams and discuss what is going well and what is not. Identify barriers to completion of action plans, and adjust the plan if necessary. Once you have the desired outcomes in the trial area, consider spreading to other areas (IHI, 2006).

It is important to be nimble and move quickly to keep team momentum going, and so that people can see the results of their labor. At the same time, don't move so quickly that you don't consider the larger, organizational ramifications of a change in your plan. Be sure to have a good understanding of the other, similar improvement projects that are taking place so that your efforts are not duplicated or inefficient.

ANTIMICROBIAL STEWARDSHIP METRICS TO CONSIDER ASSESSING	
• Length of stay • Readmission • Sepsis • Resistance patterns among microorganisms • Outcomes associated with changes in antibiotic use	• Defined daily doses • Days of therapy (DOT) of antibiotics per 1000 patient days • Clostridium difficile infections (CDI) • Providers with excessive prescribing habits

Table 4: Consider evaluating related metrics to better understand antimicrobial stewardship presence and contributing factors

What We Know About Antimicrobial Stewardship

Antimicrobial Stewardship

The 1900s witnessed the advent of antibiotics to treat conditions that would have previously been deadly. It wasn't until later that antibiotic resistance was given attention due to its significant implications for treatment and relationship to susceptibility to tangentially-related conditions.

Now, there are movements around the world to minimize antimicrobial resistance through judicious and appropriate use within hospitals and in outpatient care settings, such as community clinics and pharmacies, nursing homes, and rehabilitation centers. The Centers for Medicare and Medicaid Services and the Joint Commission now require facilities to have a formal Antimicrobial Stewardship Program in place.

Appropriate use of antimicrobials is a key part of patient safety. Inappropriate use of antimicrobials can have these unwanted effects:

- The pathogens becomes resistant to antimicrobials and spreads within the healthcare system and into the community
- The patient may have adverse reactions, superinfections, selection of resistant pathogens, and poor clinical outcomes

Antimicrobial stewardship includes efforts to promote the appropriate use of antimicrobials, including antibiotics, to prevent:

- Spread of infections
- Adverse reaction and adverse drug events
- Superinfections
- Infections that are resistant to antimicrobials
- Poor clinical outcomes

Antimicrobials are the only medicines where use in one patient can affect how well that

medicine works in another patient. Contrary to common belief, antimicrobials are not harmless medicines. In fact, studies have found antimicrobial use leads to poor outcomes, including:

- 20% of adverse drug events (Lesar, 1997; Tamma 2017)
- 19% of emergency department visits, with most from allergic reactions
- 3 times higher risks for adverse events than for aspirin, phenytoin, and clopidogrel (Shehab, Patel, Srinivasan & Budnitz, 2008)
- *Clostridium difficile*, an infection with a high risk of readmission and death

The majority (80-90%) of antibiotic use occurs in the outpatient setting and, as such, the outpatient setting should be targeted for interventions, considering that total inappropriate antibiotic use, including unnecessary use and inappropriate dispensing, is approaching 50% in all outpatient antibiotic use (Measuring Outpatient, 2019). Similarly, over 60% of the spending on antibiotics is associated with use in the outpatient setting (Measuring Outpatient, 2019).

In hospitals, it has been shown that two out of three antibiotics are prescribed for either pneumonia, kidney/bladder infections, and/or skin infections, thereby providing significant insight in improving antibiotic use through targeting (Fridkin et al., 2014; Antibiotic Use, 2017).

Case Study: Multidrug-Resistant Bacteria and Tuberculosis

Nearly 500,000 new cases of tuberculosis and 200,000 deaths were attributed to multidrug resistant tuberculosis globally in the 2013 year (Kumar, 2016). The World Health Organization fortified this evidence in an estimate that multidrug resistant tuberculosis accounted for almost 3.5% of all new tuberculosis cases (Kumar, 2016).

Due to the prevalence of inappropriate antibiotic use across healthcare settings, coupled with the variety of behaviors deemed 'inappropriate' and the significant clinical and financial consequences with non-judicious use, implementation of effective and sustainable antimicrobial stewardship should be of utmost priority to healthcare organizations as a whole.

Resources
For Antimicrobial Stewardship Improvement:
- CDC: The Core Elements of Hospital Antibiotic Stewardship Programs
- Wellcome Trust: Diagnostic Strategies for Better-Targeted Antibiotic Use
- AHA Physician Forum: Antimicrobial Stewardship
- American Journal of Infection Control: Antimicrobial Stewardship: A Collaborative Partnership Between Infection Preventionists and Healthcare Epidemiologists
- WHO: Infection Control Programmes to Contain Antimicrobial Resistance
- Timetables and Deliverables for Antimicrobial Resistance Action Plan

For General Improvement:
- CMS: Hospital Improvement Innovation Networks
- IHI: A Framework for the Spread of Innovation
- The Joint Commission: Leaders Facilitating Change Workshop
- IHI: Quality Improvement Essentials Toolkit
- SIPOC Example and Template for Download
- SIPOC Description and Example

Endnotes

Conflicts of Interest Disclosure

The Patient Safety Movement Foundation partners with as many stakeholders as possible to focus on how to address patient safety challenges. The recommendations in the APSS are developed by workgroups that may include patient safety experts, healthcare technology professionals, hospital leaders, patient advocates, and medical technology industry volunteers. Workgroup members are required to disclose any potential conflicts of interest.

Workgroup

Co-Chairs

Christopher Jerry	Emily Jerry Foundation
Rob Jordan	Chapman University School of Pharmacy
Jerika Lam	Chapman University School of Pharmacy
Jason Yamaki	Chapman University School of Pharmacy

Current Members

Steven Barker	Patient Safety Movement Foundation; Masimo
Mitchell Goldstein	Loma Linda Medical Center
Michele Holt	University of Florida, Jacksonville
Josiah Huse	Patient Safety Movement Foundation
Ariana Longley	Patient Safety Movement Foundation
Olivia Lounsbury	Patient Safety Movement Foundation
Donna Prosser	Patient Safety Movement Foundation
Sun Yang	Chapman University School of Pharmacy

Metrics Integrity

Robin Betts	Kaiser Permanente, Northern California Region

Previous Members

This list represents all contributors to this document since inception of the Actionable Patient Safety Solutions

Hania Alim	Patient Safety Movement Foundation
Linda Beneze	Monarch Medical Technologies
Michel Bennett	Patient Safety Movement Foundation (formerly)
Jacob Lopez	Patient Safety Movement Foundation (formerly)
Nats Sims	Massachusetts General Hospital

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Appendix

Appendix A: Types of ASP Committees

	RESTRICTIVE PROGRAM ASP	PROSPECTIVE AUDIT WITH FEEDBACK ASP
What is it?	In this program, select antimicrobials are put on formulary restriction for use in only select indications. To dispense a restricted antimicrobial, designated personnel usually an ID physician, ID fellow, or clinical pharmacist would need to gain approval	In this program, a retrospective (hours to days) review of antimicrobial orders takes place for targeted and in some institutions non - targeted antimicrobials for appropriateness. It is also common to find programs that use a hybrid approach in which audit and feedback are employed along with a restricted formulary.
Pro	Offers direct oversight in the use of restricted antimicrobials Reduces pathogen resistance within the hospital and communities Reduces hospital LOS Reduces risks of antimicrobial-related side effects and drug-drug interactions	Compliance is often voluntary (Dellit, 2007) Requires personnel dedicated to the ASP - most academic and medium- to-large community hospitals have personnel, but smaller hospitals may not have dedicated personnel available

Cons	Requires personnel to be available around-the-clock	Compliance is often voluntary (Dellit, 2007)
	Physicians may see this as a loss of autonomy	Requires personnel dedicated to the ASP - most academic and medium- to-large community hospitals have personnel, but smaller hospitals may not have dedicated personnel available
	Review of appropriateness only occurs with restricted agent, but not for unrestricted agents which can also lead to problems (Dellit, 2007; Goff et al., 2012)	
	Requires personnel dedicated to the ASP - most academic and medium- to-large community hospitals have personnel, but smaller hospitals may not have dedicated personnel available	