

human behavior (both the prescriber and the patient) can be difficult and often takes time, not to mention political commitment. Nevertheless, an improved understanding of what features are important in effective AMS programs has evolved (Cosgrove *et al.*, 2014; Nussenblatt *et al.*, 2013; File *et*

al., 2011; Gerber *et al.*, 2014; Spellberg *et al.*, 2016; Fleming-Dutra *et al.*, 2016; Barlam *et al.*, 2016; Schuts *et al.*, 2016; see [Table 1.3](#)).

Concerning, however, is the current rapid pace of emerging AMR both in terms of the rise of new resistant clones and

Table 1.3. Summary of the characteristics and efficacy of selected antimicrobial stewardship (AMS) strategies

Intervention factors	Antimicrobial stewardship activity		
	Preprescription approval	Postprescription review and feedback	Clinical practice guidelines
Advantages	Reduces initiation of unnecessary and inappropriate antibiotics	Can increase visibility of AMS program and build collegial relationships	Institution specific
	Optimizes empiric choices and influences subsequent use	More clinical data available for recommendations, potentially enhancing uptake by prescribers	Often well received by other providers
	Prompts review of clinical data and previous cultures at time of initiation of therapy	Can be undertaken less frequently (e.g. nondaily) if resources are limited	
	Direct control over antibiotic use	Greater flexibility in timing of recommendations	
	Provides mechanism for rapid response to antibiotic shortages	Can address deescalation of antibiotics and duration of therapy	
	Potentially decreases antibiotic costs, especially high-cost agents (e.g. antifungals)	Prescriber autonomy maintained	
Disadvantages		Provides educational benefit to clinicians	
	Impacts on use of restricted agents only	Compliance voluntary	Dissemination of knowledge does not guarantee behavior change
	Potential loss of prescriber autonomy	Typically labor-intensive	
	Affects initial empiric use more than downstream use	Success depends on delivery method of feedback to prescribers	
	May delay therapy	Prescribers may be reluctant to change therapy if patient is doing well on current therapy	
	Effectiveness depends on skill of approver	May take longer to achieve reductions in targeted antibiotic use	
	Real-time resource intensive	Interventions may require information technology support and/or purchase of computerized surveillance systems	
	Potential for manipulation of system (e.g. presenting request in a biased manner to gain approval)		
May cause prescribers simply to shift to other antibiotic agents and select for different antibiotic resistance			
Barriers to implementation	Resource-intensive, requiring an AMS specialist to be on-call	Labor-intensive, requiring stewardship specialists to review antibiotic regimens	Time intensive to develop
	Limited effect on cessation of inappropriate antibiotic use and therefore limited impact on adverse impact of prolonged therapy	Stewardship may not have the authority to make changes to ordered antibiotics	Limited evidence-base for some treatment indications may undermine guideline authority

Source: Adapted from Barlam *et al.* (2016).