4 Point-of-care interventions

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4.1 Key points

• Point-of-care interventions are a valuable component of antimicrobial stewardship.

• Point-of-care interventions provide direct feedback to the prescriber at the time of prescription or laboratory diagnosis, and provide an opportunity to educate clinical staff on appropriate prescribing.

• Examples of point-of-care interventions include:
  » reviewing appropriateness of choice of antimicrobial
  » directed therapy based on microscopy and other rapid tests
  » directed therapy based on culture and susceptibility test results
  » dose optimisation
  » parenteral-to-oral conversion
  » therapeutic drug monitoring
  » automatic stop orders.

• What interventions are selected, how they are delivered and by whom, will be determined by local resources and the expertise available.

4.2 Recommendations

4.2.1 Point-of-care interventions are included in all antimicrobial stewardship programs.
4.3 Benefits of point-of-care interventions

Point-of-care interventions (POCIs) are interventions that occur at the ward level with the treating medical team, often soon after empirical therapy has been initiated. They are one of the most effective aspects of antimicrobial stewardship (AMS) in hospitals. Although POCIs are supplemental stewardship activities according to the Infectious Diseases Society of America/Society for Healthcare Epidemiology of America, they form an important component of feedback following prescribing review. They can improve patient management and patient outcomes, and provide excellent opportunities to educate clinical staff on rational prescribing. POCIs can be delivered by a stewardship pharmacist, a stewardship team or during an infectious diseases (ID) consultation.

POCIs are a part of many successful stewardship programs. They are generally implemented simultaneously with other measures, which makes it difficult to show the benefits of these interventions alone. However, POCIs are widely recommended, especially parenteral-to-oral conversion, daily review with de-escalation, and dosage optimisation, and are included in best practice guidelines for AMS.

Despite their effectiveness, a major barrier to effective POCIs can be a physician’s reluctance to de-escalate from broad-spectrum empirical therapy if the patient is improving. The attitude can be ‘when you’re on a good thing, stick to it.’ This barrier is less common among younger prescribers who have had more exposure to the concepts of evidence-based medicine.

4.4 Directed therapy based on the prescription of a restricted antimicrobial

POCIs are used to effect hospital policies on antimicrobial prescribing (e.g. formulary restrictions). They are most effective when they take place within minutes or hours of a prescription or laboratory result being generated. A common approach is to activate a POCI whenever a prescription is received by the pharmacy for an antimicrobial that does not conform to drug and therapeutics committee prescribing (restriction) policy. For example, an inpatient prescription written by a non-authorised prescriber for a restricted antimicrobial (e.g. as a third-generation cephalosporin) is received by the pharmacy. The pharmacist may contact the prescriber directly and request that they seek authorisation, or they may refer the matter immediately to an ID physician, clinical microbiologist or registrar.

Either method permits the exchange of clinical and laboratory information so that a judgement can be made about the appropriateness of the antimicrobial. Such judgements should be based on:

- agreed treatment standards and protocols
- the individual patient's clinical circumstances.
This method of real-time communication leads to the formal endorsement of the prescription or a discussion about appropriate alternative treatments. Commonly, the recommended alternative will be a narrower spectrum agent with known equal efficacy, although there will be occasions when the appropriate alternative is another equally or even more restricted agent.

Seto et al. tried a more formal approach to delivering POCIs. They used a method of immediate concurrent feedback to communicate with the prescriber such that each prescription for a restricted agent led to a same-day review by a small designated authoritative group. The group then communicated their decision to the prescriber. However, this process may be less immediate than the one described above.

### 4.5 Directed therapy based on microscopy results and other rapid tests

For a small number of conditions, the choice of empirical therapy can be improved using microbiology results that are available minutes or hours after specimen collection. The best example is meningitis — common clinical practice is to make a semi-definitive diagnosis based on the collection of cerebrospinal fluid (CSF) via lumbar puncture, and fast specimen processing that might include the use of on-call staff after hours to conduct cell counts, Gram stains and antigen tests. With appropriate caveats around the safety of collecting CSF, this should be considered standard practice for suspected meningitis. Similarly, the choice of empirical therapy can be directed in:

- **vaginitis** — microscopy readily distinguishes between candidiasis, trichomoniasis and bacterial vaginosis, so the choice of treatment should await the results
- **urethritis/cervicitis** — microscopy can readily diagnose gonococcal disease, and is widely used in sexually transmitted disease clinics to decide on empirical therapy
- **urinary tract infection (UTI)** — dipstick testing for leukocyte esterase, protein and blood; when all three are negative, there is a very high negative predictive value for UTI, which warrants the withholding of empirical antibiotics for UTI
- **protozoal gastroenteritis** — definitive diagnosis for giardiasis, amoebiasis and some other less common protozoan parasites is possible on microscopy alone.

In many clinical settings, including hospitals, microscopy is underused. There is no published literature investigating the benefits (or otherwise) of awaiting microscopy results before deciding on appropriate antimicrobial use.

### 4.6 Directed therapy based on culture and susceptibility test results (de-escalation or streamlining)

Recent studies reporting increased mortality with inappropriate or delayed empirical antimicrobial therapy have led to advocacy of early broad-spectrum antimicrobial therapy for a number of hospital infections. Although this approach
reduces the risk of inadequate therapy, it may increase the risk of selection or acquisition of strains resistant to these agents, which may subsequently be very difficult to treat.\(^\text{12}\)

Bacterial culture results, including identification and susceptibility test results, are usually available between 48 and 72 hours after specimen collection. Results of these tests should be used to improve antimicrobial choices and optimise therapy through streamlining or de-escalation therapy.\(^\text{1, 12, 16}\) This approach uses the principle that empirical prescribing should be broad enough to cover the likely pathogens and their associated resistances, but should be converted to definitive or targeted treatment when the pathogen and its susceptibilities are known (‘start broad, finish narrow’).

There is good evidence that encouraging the treating team to modify therapy (if necessary) reduces antimicrobial exposure and makes cost savings. Typical POCIs in this category are:

- changing the antimicrobial agent
- ceasing additional antimicrobials not known to add benefit to outcomes
- ceasing antimicrobial therapy altogether (with negative culture results).

4.7 **Dosing schedule optimisation**

Optimising antimicrobial dosing is an important part of AMS and there is good evidence to support the effectiveness of this intervention.\(^\text{1}\)

Pharmacists can play an important role in identifying deviations from recommended dosing schedules when reviewing medication orders and dispensing prescriptions. This provides an opportunity to discuss the doses and dosing frequency immediately with the prescriber, with a view to optimising a patient’s dosing schedule. The pharmacokinetic and pharmacodynamic features of the antimicrobial should be taken into account in this discussion.

Antimicrobial dosing schedules can be optimised in a range of ways:

- checking doses against a prescribing standard such as *Therapeutic Guidelines: Antibiotic*\(^\text{19}\) and adjusting them when they are not comparable (e.g. excessive doses of beta-lactams are commonly prescribed)
- adjusting dosing interval where circumstances are appropriate, for example
  - changing aminoglycoside from three times daily to once daily for almost all indications
  - considering a switch to continuous infusion of short half-life beta-lactams (e.g. piperacillin/tazobactam, cefepime, meropenem) for some infections, especially those requiring treatment beyond 5–7 days
• monitoring antimicrobial levels in an individual patient and adjusting dosing to maximise efficacy, while minimising toxicity (e.g. with aminoglycosides andazole antifungals); the *Therapeutic Guidelines: Antibiotic* provides guidance on the monitoring of aminoglycosides and vancomycin.

Anecdotally, convincing prescribers to change dosing regimens can sometimes be challenging, especially if it involves reducing the initially prescribed doses.

### 4.8 Duration

The weight of evidence suggests that resistance selection increases with longer courses of antimicrobials. Incorrect duration of antimicrobial use is a frequent problem in hospital prescribing. Surgical prophylaxis that is administered beyond one dose or one day is a common example. Hospitals should have policies for the prophylactic use of antimicrobials that state that a single dose is the preferred option. (See example in Appendix 2, Section A2.1.)

Microbiologists and ID physicians are frequently asked for advice on duration of treatment. Almost all infections have standard treatment durations. Duration of therapy often needs to be tailored to individual responses to treatment, especially considering delayed responses in immune compromised patients. Nevertheless, in the context of advising on therapy, antimicrobials should generally be prescribed for a maximum of seven days, or a shorter period if this is clinically appropriate.

It is important to embed a prescribing culture that includes daily review and setting a maximum duration of treatment, unless there is a clear indication in the medical record that therapy should be continued.

### 4.9 Parenteral-to-oral conversion

The acquisition and administration costs of intravenous therapy are almost always higher than those of oral therapy. However, oral therapy is preferred for other reasons. It is in the best interests of the patient to be discharged to their home environment once they are clinically stable and able to take oral therapy. Continued hospitalisation is associated with the risk of a new multidrug-resistant infection, increase in *Clostridium difficile* infection, or a preventable adverse event such as an infection from the intravenous line. Encouraging a switch to oral therapy once the patient has shown significant clinical response to treatment is a well-studied strategy that has proven value.

Certain antimicrobials have near complete bioavailability and some oral therapies have been shown to be as effective as parenteral therapy. For agents available in both oral and parenteral formulations — and with high bioavailability — a switch to oral treatment as soon as it is clinically safe to do so is relatively simple. Examples include fluoroquinolones, linezolid, fluconazole and voriconazole. For some parenteral agents, there is no obvious oral equivalent (e.g. vancomycin), so alternative oral agents of known efficacy are used. Although expensive, the use of
linezolid in the treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) infection is associated with a shorter length of hospital stay compared with parenteral vancomycin, which can potentially free up hospital beds.\(^{15}\)

Prescribers are often reluctant to convert to oral treatment in patients who are still febrile, but studies have shown that if there are other clinical objective criteria showing that the patient has responded well, the fear of conversion is unfounded.\(^1\) Defined criteria can be established and agreed upon that allow a stewardship team to expedite the change to oral therapy. The *Therapeutic Guidelines: Antibiotic*\(^{19}\) provide guidance on when oral therapy should be used in preference to parenteral therapy. (See Section A2.1 in Appendix 2 for examples of local guidelines and educational materials.)

The National Health Service summary of best practice on antimicrobial prescribing\(^{18}\) recommends as a general rule that intravenous antimicrobials should only be prescribed for two days, after which the prescription should be reviewed and, if appropriate, the patient switched to oral therapy.

Benefits of the oral switch include:\(^1\)

- lower treatment costs
- reduced morbidity from (now removed) intravenous lines
- reduced length of stay
- higher patient satisfaction.\(^{86}\)

### 4.10 Who should provide point-of-care interventions?

In general, POCIs involve one or two relevant individuals providing information and recommendations to the prescriber. The individuals may or may not be formal members of an AMS team, but could be any trained member of pharmacy, ID or clinical microbiology services. The role of these services in providing POCIs is further discussed in Chapters 7–9. Institutions necessarily vary how they deliver interventions (including by whom); this will be determined by local resources and the availability of expertise.