

Guidelines for Antimicrobial Stewardship Training and Practice

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Executive Summary

The escalating threat of antimicrobial resistance has resulted in a heightened interest in antimicrobial stewardship (AS), a strategy that encompasses a broad range of interventions directed towards fostering more prudent use of antibiotics, thereby improving the long-term sustainability of current available antimicrobial agents. AS is a relatively new multidisciplinary field, and there are no consistent training or practice standards in Singapore at this point in time.

The establishment of a set of guidelines for antimicrobial stewardship training and practice will help to ensure that all antimicrobial stewardship practitioners are trained to provide a high standard of care, and that their practice is safe and effective. This will promote confidence in antimicrobial stewardship among other healthcare professionals and the general public, and ease the implementation of AS programmes (ASPs) in our hospitals.

The guidelines are as follows:

- Anyone who establishes, provides or advises on AS services must be on a relevant professional registry such as the Register of Pharmacists, the Register of Specialists (for physicians) or their equivalent.
- All AS practitioners should receive specific training in

AS and attend regular educational updates. Those new to AS should be supervised by an experienced AS practitioner and attend a formal course at the earliest opportunity.

- The basic training for AS practitioners should as a minimum include all the core areas of knowledge listed in this document as well as a supervised AS practicum. All AS practitioners should be capable of demonstrating understanding, competence, skills in and up-to-date evidence-based knowledge of these core areas.

- The minimum duration of the supervised practicum should be 4 weeks, comprising at least 80 hours dedicated towards AS training. Continuing educational updates must be provided for and attended by those who have completed the formal basic training.

- Institutions and other bodies responsible for clinical governance should ensure that staff training is included in regular audits of the local ASP.

Background

The constant threat of antimicrobial resistance coupled with a diminishing antibiotic pipeline has resulted in a heightened interest in antimicrobial stewardship (AS), a field that encompasses a broad range of strategies and

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Table 1. Summary of strategies commonly employed in Antimicrobial Stewardship (AS) and possible barriers to its implementation

Antimicrobial Stewardship Strategy	Barriers to Effective Implementation of AS
1. Prospective audit with intervention and feedback of targeted antibiotics	1. Lack of funding or personnel
2. Formulary restriction and preauthorization requirements	2. Hospital administration's and prescribers' unawareness on role and need for AS
3. Education	3. Opposition from prescribers due to perceived challenge to autonomy
4. Development and implementation of guidelines and clinical pathways	4. Lack of information technology support or inability to obtain data
5. Streamlining or de-escalation of therapy	5. Lack of awareness and adherence to guidelines and pathways
6. Dose optimization	
7. Parenteral to oral conversion	
8. Computer surveillance and decision support	
9. Microbiology laboratory reporting and surveillance	

interventions (see Table 1) directed towards fostering more prudent use of antibiotics, thereby improving the long-term sustainability of current available antimicrobial agents. The primary goal of AS is not restricted to limiting inappropriate prescription, but involves optimising antibiotic selection, dose, route and duration of therapy in order to yield the best outcomes while minimising unintended detrimental events such as adverse drug events, excessive costs and emergence of resistance.¹⁻⁵

Effective AS programmes (ASPs) can be financially self-supporting, with the added benefits of reducing healthcare costs and enhancing patient safety.⁶ The ultimate goal of any ASP is to improve patient care and health outcomes associated with antibiotic use.¹

However, AS is a relatively new field that is multidisciplinary in nature, with a paucity of high quality evidence addressing both successful programme implementation as well as the choice of the most appropriate interventions under varied clinical settings.⁷⁻⁹ Implementation of AS interventions may meet with different barriers (see Table 1).^{9,10} Moreover, executing these interventions, at least at the start, almost invariably generates friction between AS practitioners and physicians concerned primarily with the effects of antibiotics on their individual patients.

It is clear that AS practitioners need to be confident, highly knowledgeable, up-to-date, and possess a positive attitude towards their work. Good training programmes emphasising practical hands-on experience and regular educational updates should be provided to accomplish this.^{9, 11, 12}

Current Standard of Training and Practice

The formal practice of AS is relatively new in Singapore, although many hospitals—notably Tan Tock Seng Hospital (TTSH)—have practiced some form of formulary restriction

and pre-authorisation of antibiotics since the 1990's. The Singapore General Hospital (SGH) was the first to launch a prospective audit and feedback style ASP in 2008, one of two major ASP intervention strategies that was subsequently also adopted at TTSH and the National University Hospital (NUH), albeit with some differences in practice. This is a two-tiered format composed of AS providers—currently trained clinical pharmacists who perform routine auditing as well as feedback on less complex clinical cases—and AS clinicians—currently infectious diseases (ID) physicians and microbiologists who provide clinical expertise and recommendations on more complex cases.

In addition, the TTSH ASP also maintains and updates the hospital's patented computerised clinical decision support system (CDSS) for antibiotic prescription: Antimicrobial Resistance Utilization and Surveillance Control (ARUS-C). Virtually all the pioneer AS practitioners—both providers and clinicians—were self-taught, learning via practice and from international conference presentations and workshops. The outcomes of each programme are audited by the respective AS practitioners at each hospital.

There is currently no nationally agreed standardised training programme for AS providers and clinicians. AS is not explicitly taught as part of any undergraduate curriculum or postgraduate physician specialty training programme (such as ID or microbiology). The SGH ID pharmacy residency programme provides AS training as part of its one-year residency.¹³ However, the primary aim of this programme is to impart postgraduate training in ID, generating ID specialist pharmacists with a broader domain of expertise than just AS. Various hospitals are also considering establishing AS training programmes to train new AS providers. Under such circumstances, the possibility that a variety of standards in AS training and practice may arise is significant.

The intention of this set of guidelines is to provide

consistency in AS training and practice across the country. The current achievements of existing ASPs are to their credit. These guidelines should support AS practitioners to build on their success. Well-implemented training for healthcare professionals has the potential to prevent serious adverse events, therefore specific training in AS should be seen as a priority for all institutions preparing to set up or expand ASPs.

Aims and Objectives of this Document

The aims of the Guidelines for AS Training and Practice are to ensure that all AS practitioners are trained to provide a high standard of care and ensure that their practice is safe and effective. This will promote confidence in AS among both other healthcare professionals as well as the general public.

The objective is to enable AS practitioners to confidently, competently and effectively execute AS in their respective institutions.

This document will achieve these aims and objectives via:

1. Helping to promote national consistency and high quality AS practice.
2. Providing a curriculum framework, thus enabling those in charge of organising local AS courses and training to ensure that all core areas of knowledge and competency are covered.
3. Defining the minimum level of training that should be provided.

Who are these Guidelines for?

These Guidelines serve as a guidance document for all healthcare professionals involved in AS activities in Singapore. Everyone establishing, providing or giving advice on AS services as part of their clinical practice—including infectious diseases physicians, microbiologists, pharmacists and other healthcare professionals—should have access to training. Ideally, such individuals should receive formal training in AS and should attend regular educational updates.

Note that the establishment of these guidelines does not imply that advice on antibiotic therapy can only be provided by trained AS practitioners. Healthcare professionals such as pharmacists and physicians are often called upon to provide such advice in addition to or as part of their routine work. However, advice on antibiotic therapy forms the core of the AS practitioners' work, with the added dimension of working towards the long-term sustainability of antibiotics as a valuable resource.

Although the level of detail and subjects covered may vary according to their role or institution, the training should meet

these guidelines, which are established to address both the future training of healthcare professionals interested in AS as well as the provision of educational updates for current AS practitioners. The introduction of these guidelines does not mean that healthcare professionals presently providing AS services should be prevented from practising or be made to attend a training course. It is hoped that the guidelines should enable these professionals to gain access to further training and have the opportunity to attend regular updates.

Core Areas of Knowledge

The proposed guidelines for AS practice and training are as follows:

Practitioners:

- Anyone who establishes, provides or advises on AS services must be on a relevant professional registry such as the Register of Pharmacists, the Register of Specialists (for physicians) or their equivalent.

Training requirement:

- All AS practitioners should receive specific training in AS and attend regular educational updates. Those new to AS should be supervised by an experienced AS practitioner and attend a formal course at the earliest opportunity.

Training content and duration:

- The basic training for AS practitioners should as a minimum include all the core areas of knowledge outlined below as well as a supervised AS practicum. All AS practitioners should be capable of demonstrating understanding, competence, skills in and up-to-date evidence-based knowledge of these areas.
- The minimum duration of the supervised practicum should be 4 weeks, comprising at least 80 hours dedicated towards AS training. Continuing educational updates must be provided for and attended by those who have completed the formal basic training.

Evaluation:

- Institutions and other bodies responsible for clinical governance should ensure that staff training is included in regular audits of the local ASPs.

This section outlines the essential topics that should be incorporated into all AS training. The current structure of ASPs in Singapore and many institutions worldwide contain 2 distinct roles:

- An operational role often filled by trained pharmacists or nurses, responsible for primary audit of antibiotic prescription and for providing basic AS support (e.g. recommendations for switching from intravenous to oral antibiotics, drug dosages) – hereafter termed as the 'ASP provider'.

- A decision-making role often filled by trained physicians or infectious diseases specialist pharmacists, responsible for adjudicating on the appropriateness of antibiotic prescriptions, particularly for complex cases – hereafter termed as the 'AS clinician'.

We have thus separated the core areas of knowledge for both these roles. We intend for this section to be used as a framework around which training programmes can be built to meet the guidelines, therefore only broad topic headers are provided as the flexibility to address local needs and existing training programmes is critical. The majority of these topics are already included into certain local training programs such as the ID Pharmacist Residency Programme at the Singapore General Hospital and the advanced specialty training in infectious diseases for physicians. However, practical experience in and exposure to AS work is critical for both AS providers and clinicians, and we recommend that a supervised practicum of at least 4 week's duration, involving at least 80 dedicated hours for AS exposure and training for providers and 20 dedicated hours for clinicians, should comprise the core of any training programme.

Core Knowledge for the AS Provider

1. Knowledge and skills necessary for the establishment of an ASP:

- Aims of ASP.
- Types of AS strategies, including but not limited to:
 - Prospective audit and feedback.
 - Formulary restriction and pre-authorisation.
 - Clinician decision support systems.
- Issues, controversies and ethics of AS.

2. Clinical knowledge and skills required for the practice of AS:

- Pharmacology of anti-infective agents including:
 - Pharmacodynamics and pharmacokinetics (PK/PD).
 - Application of PK/PD principles to anti-infective dosing.
 - Monitoring of common adverse effects and drug interactions.
 - Spectrum and activity, and clinical indications of anti-infective agents.
- Basic microbiology and infectious diseases:
 - Diagnostic criteria, treatment options and existing clinical guidelines for common infections.
 - Common human pathogens (bacteria, fungi, viruses, parasites).

- Common antimicrobial resistance profiles and treatment options directed against these.

- Limitations of current diagnostic techniques for infectious diseases.

c. Interpretation of antibiograms and their utility.

d. Basic clinical skills:

- Communication with patients and healthcare providers.

- Basic clinical evaluation including assessment of gastrointestinal absorption and severity of infection (including the role of biomarkers e.g. procalcitonin and C-reactive protein, and acute illness severity assessment and scoring e.g. Pitt bacteraemia score, APACHE II, SAPS), clinical documentation and reporting.

3. Measurement of the outcomes and impact of an ASP:

- The importance and process of collecting and analysing data to audit and drive ASP.
- Process and outcome indicators in ASP.
- Surveillance of antimicrobial resistance and prescription.

Core Knowledge for the AS Clinician

1. All of the core knowledge for AS Provider.

2. Comprehensive understanding of antibiotic pharmacology.

3. Comprehensive understanding of infectious diseases:

- Diagnostic tests and their interpretation.
- Treatment guidelines.

4. Advanced clinical skills, particularly in patient evaluation and infectious diseases clinical care.

5. Optional (good-to-know) topics for both AS providers and clinicians include:

- Principles of clinical research.
- Appreciation of pharmacoeconomics of AS programmes as continuous effort is required to justify its existence to management and/or consumers.

Competency Assessment

AS trainers and programme directors should develop effective strategies for the assessment of both theoretical knowledge and clinical competence for both formal AS training courses as well as on-the-job training.

Evaluation of theoretical knowledge may be done in a variety of ways, such as through summative formal written tests and/or oral viva, or formative informal assessments during the practicum (or on-the-job training), or any combination of the above.

Supervised clinical practice during the practicum for new AS practitioners will help with the integration of theoretical knowledge and clinical practice. The AS practitioner in question should be observed for a minimum number of AS sessions to demonstrate that he/she has attained the required clinical competencies such as those listed above.

Documentation of satisfactory completion of competency assessment is recommended.

Continuing Education

To ensure that AS practice and recommendations remain relevant, AS providers and clinicians should continually update themselves on the latest developments of antimicrobial use and resistance, as these will change over time. They should be aware of the latest updates in disease-specific guideline recommendations by professional societies such as the Infectious Disease Society of America (IDSA), as well as the evidence behind these recommendations. Knowledge of infection control principles and practice, such as guidelines by the Society for Healthcare Epidemiology of America or the Hospital Infection Society, is complementary to the practice of AS.

A regular and ongoing programme of educational updates for AS practitioners is a priority. This can be developed “in-house” in each institution or as a national programme. We recommend, as a minimum, that annual updates should be provided for all AS practitioners who have completed the relevant training courses. This will likely require the equivalent of a half-day session to cover the relevant parts of the latest developments and updates described above.

Delivery of Training

AS training should be a combination of didactic- and practice-based learning, ideally with half the practicum taking place at the local institutional level where possible to minimise issues of inter-institutional practice variation and to make the training more relevant for the AS practitioners. This is currently not possible because not all local hospitals have ASPs or the necessary training expertise, but may become viable in the future. The minimum curriculum is specified earlier in this document, and it would be beneficial to involve a variety of specialist speakers (e.g. infectious diseases physicians, pharmacists, microbiologists, biostatisticians) in teaching the theoretical aspects of AS.

Resources Required to Meet the Guidelines

Although there is currently no definitive teaching resource or manual for AS training, such resources are available and may be collated from a wide variety of sources. The IDSA guidelines by Dellit and co-workers published in

2007 offers an overview of ASPs,¹ while online courses such as the MAD-ID Antimicrobial Stewardship Training Programme (available at http://www.mad-id.org/asp/asp_index.htm) host online lectures and documents relevant to AS training and practice. Locally, the SGH ID Pharmacist Residency Programme has developed training material for AS providers.¹³

Plans for developing more local training resources for both AS providers and clinicians are in place, and these will be made available through various channels including the major hospitals mentioned above.

Implementation and Evaluation of the Guidelines

Successful implementation of the guidelines will require:

1. Provision of adequate resources to support training and practice of AS.
2. Leadership and the coordination of both training and practice.
3. Trainers with the required expertise.

Conclusion

It is important that the provision of AS training should be seen as a priority for funding, support and other resources by institutions that have established or are looking to develop ASPs as well as relevant professional bodies. The benefits of training in areas such as clinical governance and risk management are clear. As part of good clinical governance, institutions and professional bodies should be responsible for assessing whether the guidelines are being met for both AS training and practice. Meeting the standards recommended by these guidelines will potentially minimise adverse incidents and thus impact on resources and patient safety.

At the national level, these guidelines and the curriculum framework could be regularly assessed via surveys of institutional ASPs, with a focus on the implementation of the guidelines as well as the barriers encountered. Separately, the National Antimicrobial Taskforce convened by the Ministry of Health (MOH), Singapore has developed process and outcome measures for ASPs. These pertain to the performance of the ASP rather than practice standards. Nonetheless, these are important for evaluating the impact and success of ASPs in the individual institutions.

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