



# **ANTIMICROBIAL PRESCRIBING POLICY AND PRACTICE IN SCOTLAND**

**RECOMMENDATIONS FOR GOOD ANTIMICROBIAL PRACTICE IN ACUTE HOSPITALS**

SCOTTISH MEDICINES CONSORTIUM / HEALTHCARE ASSOCIATED INFECTION TASK FORCE



SCOTTISH EXECUTIVE

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Scottish Medicines Consortium

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**AUGUST 2005**



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## EXECUTIVE SUMMARY

1. This guidance document on prudent use of antibiotics and other antimicrobial drugs has been produced for NHSScotland by the Scottish Medicines Consortium. It fulfils one of the requirements set out in the Antimicrobial Resistance Strategy and Scottish Action Plan (SEHD 2002)<sup>1</sup>, and forms part of the Healthcare Associated Infection (HAI) Action Plan<sup>28</sup> work programme overseen by the Ministerial HAI Task Force.

2. The development of drug-resistant strains of micro-organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA) is an increasing problem worldwide, and has potentially disastrous consequences if not addressed. One of the main weapons in managing resistance is the adoption of good prescribing practice for antimicrobials.

3. Patient mortality and morbidity are both increased in drug-resistant infections. Management of these infections is resource intensive in terms of treatment costs, bed occupancy and staff time.

4. This is a key clinical governance area, and a recent survey of practice in the acute sector confirms wide variations in practice and monitoring.

5. The core components of the current guidance are:

- a. Development of prescribing policies
- b. Monitoring of compliance
- c. Structures and responsibilities
- d. Training
- e. Audit and performance management.

# Scottish Antimicrobial Prescribing Policy and Practice Group Recommendations for Good Antimicrobial Practice in Acute Hospitals

## INTRODUCTION

Prudent antimicrobial prescribing is at the core of the Scottish Action Plan on Antimicrobial Resistance<sup>1</sup>, alongside surveillance of resistance and control of healthcare associated infection (HAI). Prudent antimicrobial prescribing requires multidisciplinary collaboration with a rigorous approach to combining the best available research evidence with detailed knowledge of local clinical needs and antimicrobial resistance.<sup>1-6</sup>

Membership of the Scottish Medicines Consortium (SMC) has been derived from NHS Boards in Scotland and includes physicians, pharmacists, a nurse, health economists, finance directors, Board Chief Executives, representatives of remote Boards, Association of British Pharmaceutical Industry, and patient & voluntary group representatives. SMC's potential role in promoting prudent antimicrobial prescribing was explicitly recognised in the Scottish Action Plan in 2002.

*“The establishment of a new body, the Scottish Medicines Consortium (SMC), brings together Area Drugs and Therapeutics Committees (ADTCs) and the pharmaceutical industry. This new body will co-ordinate across Scotland work done to evaluate (in terms of clinical and cost effectiveness) new medicines, new formulations and new indications for existing medicines, including antimicrobial agents. The possibility of it being used to provide a forum in which antimicrobial prescribing policies across Scotland can be co-ordinated will be explored..... Drug and Therapeutics Committees are key in the development, implementation and review of formularies and policies on the management and appropriate use of antimicrobials. These formularies and policies will be informed by national initiatives including SIGN guidelines, the work of the Health Technology Board and the Scottish Medicines Consortium”.*

In Scotland there are a number of challenges related to antimicrobial prescribing facing hospitals. These have been recognised by the Scottish Executive Health Department and SMC and relate to:

- Evidence of wide variation in antimicrobial prescribing policy and practice
- Concern about insufficient regular liaison between microbiologists, clinicians and pharmacists
- Concern about inadequate supervision of prescribing and inappropriate choice, duration and records of administration by junior doctors
- Need for work particularly on standardisation of approaches to acute hospital prescribing of antimicrobials
- Evidence of suboptimal linkage between prescribing and infection expertise
- Need for hospital wide multidisciplinary approaches to antimicrobial prescribing including role and limitations of medicines, knowledge of local susceptibility patterns, use of intravenous (iv) and oral routes, duration of treatment and

prophylaxis, monitoring of levels, and routine collection of data in relation to outcomes, streamlining/rationalisation and use of laboratory results

A short life project group (APP&P) was set up to address the issue of antimicrobial prescribing policy and practice in Scottish acute hospitals and advise the SMC on future strategy in this area.

## **Objective**

The objective of this group was development of a set of Good Practice Recommendations for Antimicrobial Prescribing in Hospitals to be implemented at the national or local level.

## **Methodology, Remit & Implementation**

It was agreed to adopt a consensus based approach using existing international<sup>2,4,5,7</sup>, national<sup>1,3,8-13</sup> and local evidence with expert opinion<sup>14,15</sup> represented within the multi-disciplinary group. The important work of the Scottish Infection Standards and Strategy (SISS) Group on Antimicrobial Prescribing in Hospital<sup>15</sup>, other published literature related to investigating antimicrobial usage through selected indicators<sup>16</sup> and suggestions related to improving undergraduate education<sup>17</sup>, were used as a valuable starting point for the APP&P group's deliberations. This group aims to further develop this work and produce a useful national and local framework for good antimicrobial prescribing in hospitals. It was not within the groups remit to (1) consider community antimicrobial prescribing or (2) provide a national template for hospital antimicrobial policies. However, as many of the principles defined in this document are generic and applicable to other healthcare settings, it would be reasonable to commend the development of such a framework for primary care. Furthermore, the development of guidance for preparation and revision of hospital and community antimicrobial policies is clearly desirable<sup>1,3,4,12</sup> and the APP&P group support the development and Scottish adoption, after due consideration, of the work currently being undertaken nationally by the Specialist Advisory Committee on Antimicrobial Resistance (SACAR) <http://www.advisorybodies.doh.gov.uk/sacar/contact.htm>.

The recommendations here should provide clear points of action for implementation by bodies or persons identified in this document. Some of these recommendations require national co-ordination and implementation whilst others lie at the NHS board or local level. It is envisaged that the ongoing responsibility for monitoring the impact and effect of the processes identified, and future responsibilities, will be placed with an appropriate national body as part of the HAI Task Force strategy.

Six key areas of practice were identified. Subgroups developed and categorised good practice recommendations for these areas. The Working Group regards all recommendations as essential unless otherwise indicated

## SUMMARY OF KEY AREAS

Good practice recommendations relate to the following key areas:

	<b>Key Area</b>
<b>1</b>	<b>Establish standard structures and lines of responsibility &amp; accountability in NHS Boards across Scotland.</b>
<b>2</b>	<b>Define structures and responsibility for multi-disciplinary and generic undergraduate and post-graduate training related to antimicrobial prescribing.</b>
<b>3</b>	<b>Define the minimum dataset requirements and standard procedures for collecting information related to antimicrobial resistance patterns.</b>
<b>4</b>	<b>Define the minimum dataset requirements and standard procedures for collecting information related to antimicrobial consumption and quality of prescribing at an organisational level and/or ward specific level.</b>
<b>5</b>	<b>Define the key areas for acute hospital policy and recommendations for audit.</b>
<b>6</b>	<b>Develop and define performance indicators that could be used to assess or gauge performance related to antimicrobial prescribing in hospitals</b>

## **Key Area 1**

### **Establish standard structures and lines of responsibility & accountability in NHS Boards across Scotland**

#### **Introduction**

There are local structures and policies to facilitate clinical and cost effective antimicrobial use within many hospitals in Scotland. However, the widespread use of antimicrobials across all clinical specialties means that often the infrastructure lacks leadership and co-ordination across the hospital to support the ongoing monitoring and development of Antimicrobial Prescribing Policy and Practice. Clear lines of communication and accountability between key professionals and with the organisation's clinical governance framework may be absent. Existing structures should therefore be reviewed to ensure that the infrastructure is in place for effective local and national leadership, accountability and co-ordination of APP&P.

#### **Recommendation 1: National Structure**

A national organisation should develop the national infrastructure to support implementation of APP&P. A national clinical forum should be established to facilitate networking across NHSScotland in APP&P.

#### **Recommendation 2: NHS Board Responsibility**

2.1 Chief Executives of NHS Boards, who are responsible for clinical governance, should also have an overall responsibility for APP&P in acute hospitals within their NHS Boards. They should ensure that a local framework is in place for the implementation of the APP&P. Management processes relating to APP&P form part of the responsibilities of the Infection Control Manager (Health Department Letter HDL(2005)8).

2.2 The Board is responsible for establishing systems, including information technology (IT), for implementing key areas 2-6.

#### **Recommendation 3: Hospital Structures**

3.1 A lead acute hospital Doctor and Pharmacist for Antimicrobial Prescribing Policy and Practice in hospitals should be identified within each NHS Board.

3.2 A multi-disciplinary antimicrobial management team (AMT) for antimicrobial prescribing should be formed. This should include the above Lead Doctor and Pharmacist, a microbiologist and/or infectious diseases physician, and a senior management representative (normally the Infection Control Manager). This team should be responsible for implementing the Antimicrobial Prescribing Policy and Practice. A model structure is described in Figure 1.

3.3 All acute hospitals should have an antimicrobial policy and formulary (see Appendix 1). A recent template for hospital antimicrobial prescribing policies from SACAR may be helpful<sup>30</sup>.

#### **Recommendation 4: Hospital Responsibility and Accountability**

4.1 Clear lines of accountability should be defined between the Chief Executive, the Lead Clinician/Pharmacist, the Drugs and Therapeutics Committee (DTC) and AMT.

4.2 The local AMT should maintain responsibility for antimicrobial policy and formulary management, in response to national guidance and local susceptibility data (see key areas 4 & 5).

4.3 The AMT should have clear responsibilities and ways of working with the DTCs and Infection Control Committee (Appendix 2).

4.4 All clinical practitioners have a responsibility to follow good Antimicrobial Prescribing Policy and Practice in keeping with Clinical Governance.

## **Key Area 2**

**Define structures and responsibility for multi-disciplinary and generic undergraduate and post-graduate training related to antimicrobial prescribing**

### **Introduction**

Appropriate and prudent prescribing of antimicrobial agents requires a firm educational grounding for undergraduates consolidated with further training throughout the postgraduate years. The ongoing application of the principles of antimicrobial prescribing is essential. The following section provides guidance and recommendations for a postgraduate framework of antimicrobial education for all persons with prescribing responsibilities.

### **Recommendation 5**

The AMT should take ownership for defining competencies and skills required for prudent antimicrobial prescribing, based where appropriate on national models.

### **Recommendation 6**

There should be a structured multi-disciplinary postgraduate teaching programme for any professional involved in antimicrobial prescribing or administration, designed to improve competence at all levels; regular repetition is required, where appropriate, due to the frequency of job changes with this group of prescribers. The Royal Colleges of Physicians, of Surgeons and of Nursing, and the Scottish Branch of the Royal Pharmaceutical Society together with NES could play an important role in developing these programmes.

### **Recommendation 7**

Teaching can be in any format but participation should be documented in a CPD portfolio. The *NHSScotland Code of Practice for the local management of hygiene and healthcare associated infection*<sup>29</sup> stipulates that healthcare workers must have specific HAI-related CPD objectives – this would include antimicrobial prescribing. There should be an assessment of competency for prescribing related to antimicrobials. Regular updates should also be built into a rolling educational programme for all staff.

### **Recommendation 8**

Scottish Deans Curriculum Group should be asked to consider outcomes of undergraduate medical education on prudent antimicrobial prescribing.

## **Key Area 3**

**Define the minimum dataset requirements and standard procedures for collecting information related to antimicrobial resistance patterns**

### **Introduction**

Clinicians should make appropriate use of the local laboratory to guide antimicrobial therapy. Laboratories should perform susceptibility tests using appropriately rigorous methodology to provide clinically useful information for the clinician and epidemiological data to inform antimicrobial and infection control policies.

### **Recommendation 9**

For the purpose of both appropriate patient management and antimicrobial resistance surveillance, blood cultures should be submitted before antimicrobial administration in all patients with possible bacteraemia, so long as clinical care is not compromised by significant delays in starting treatment. These data can be correlated with antimicrobial consumption at a ward or unit level to enable better benchmarking of prescribing.<sup>18</sup>

### **Recommendation 10**

MICs or zone sizes must be measured for all clinically relevant bacterial isolates.<sup>19</sup>

### **Recommendation 11**

Susceptibility to non-formulary or restricted agents should not be routinely reported.<sup>20</sup>

### **Recommendation 12**

Standard systems should be in place for bringing antimicrobial resistance alerts to the notice of infection control team to enable rapid instigation of appropriate infection control precautions.<sup>2</sup>

### **Recommendation 13**

The institution's laboratory susceptibility data should be published annually and used to inform prescribers, policies and formularies in different areas of the hospital. Duplicate isolates should be removed from the analysis.<sup>21, 22</sup>

## **Key Area 4**

**Define the minimum dataset requirements and standard procedures for collecting information related to antimicrobial consumption and quality of prescribing at an organisational level and/or ward specific level.**

### **Introduction**

Monitoring of hospital consumption was one of the key recommendations of the 1998 House of Lords report on antimicrobial resistance. Six years later the UK still has no routine data about antimicrobial use in hospitals. In contrast 23 of the 31 other countries in Europe were able to contribute hospital data to the 2003 ESAC (European Surveillance of Antimicrobial Consumption). A key finding of ESAC was significant variation in the interpretation of units of measurement of use (Defined Daily Doses, DDD) and clinical activity (bed days), which must be carefully standardised in order to compare use between hospitals.

### **Recommendation 14**

A national agency should collate and report antimicrobial utilisation trends across Scotland.

### **Recommendation 15**

All acute hospitals should analyse and report antimicrobial use using the WHO DDDs (see <http://www.escmid.org/Seviware/Script/SvFiles.asp?Ref=404>) as the numerator and total occupied bed days as the denominator.

### **Recommendation 16**

Responsibility for setting standards and reporting hospital antimicrobial use should be clearly identified and implemented within all acute hospitals.

### **Recommendation 17**

In order to facilitate audits of antimicrobial prescribing there should be national co-ordination of minimum datasets for clinical records to support prescribing for common infections.

## **Key Area 5**

### **Define the key areas for acute hospital policy and recommendations for audit**

#### **Introduction**

Audit is a useful tool employed in strategies to promote and maintain the safe and cost-effective use of antimicrobials. Quantifying the volume or consumption of antimicrobials is useful but does not indicate the quality of antimicrobial use. The healthcare provider should develop and maintain the infrastructure to promote best antimicrobial practice.<sup>25</sup> Figure 1 outlines key components of this infrastructure and how they may interact with appropriate feedback mechanisms. Best practice should be introduced or maintained by individual prescribers. Evaluation of this should be the work of the AMT<sup>26, 27</sup> and assessed through surveys of individual practice (e.g. point prevalence surveys of antimicrobial use such as the one undertaken by the STRAMA group in Sweden<sup>23</sup>). A local example of such a tool is attached as Appendix 3. Such surveys can inform more detailed audits in key areas where potential anomalies in prescribing may be identified. On a day-to-day basis, ward-based clinical pharmacists, supported by the AMT, should be empowered to feed back concurrently to prescribers (see Figure 1).

#### **Recommendation 18**

Hospital Prescribing Policy/Guidelines should be developed and implemented (Appendix 1.1).

#### **Recommendation 19**

Policies and guidelines should be reviewed annually (as a minimum) by the AMT.

1. Adherence to guidelines should be monitored (Appendix 1.2).
2. A process for feedback of information to prescribers and to the AMT should be in place (Appendix 1.3).

## **Key Area 6**

**Develop and define performance indicators that could be used to assess or gauge performance related to antimicrobial prescribing in acute hospitals**

### **Introduction**

During our initial discussions about the remit of this group, there was unanimous support for developing a performance indicator to be considered by SEHD for inclusion in the Performance Assessment Framework and Health Action Plan for each NHS Board. It was felt that this would provide the incentive for ensuring a core marker of compliance with the APP&P recommendations. The aim was an indicator to reflect an important, measurable, valid, reliable and evidence-based measure of antimicrobial prescribing in acute hospitals. Such an indicator presently exists for Primary Care and whilst systems in hospitals may not exist presently to measure this readily, the group felt very strongly that these must be put into place in the near future. See key area 5. The other two recommendations<sup>13, 24</sup> are based on existing national recommendations and reflect common and important indications for antimicrobial prescription.

### **Recommendation 20**

Systems should be in place to measure:

1. antimicrobial consumption by defined daily dose (DDD)/1000 bed days for key antimicrobials. Once such systems are developed and their interpretation refined they should be considered for assessment as an additional Board Performance Indicator.
2. the number of courses of antimicrobial therapy exceeding 24 hours, expressed as a percentage of the total number of courses in patients having clean surgery.
3. the number of antibiotic courses prescribed in line with hospital policy for community acquired pneumonia (CAP), expressed as a percentage of all antibiotic courses prescribed for CAP.

## REFERENCES

1. Scottish Executive Health Department 2002. Antimicrobial Resistance Strategy and Scottish Action Plan.: SEHD Edinburgh UK:  
<http://www.scotland.gov.uk/library5/health/arsap-00.asp>
2. Goldmann RA, Weinstein RA, Wenzel RP et al. Strategies to prevent and control the emergence and spread of antimicrobial-resistant microorganisms in hospitals. JAMA 1996;275:234-240.
3. House of Lords Select Committee on Science and Technology. Session 1997-1998, 7<sup>th</sup> Report, 1-108. Resistance to antibiotics and other antimicrobial agents. Chairman Lord Soulsby. London: The Stationery Office  
[www.publications.parliament.uk/pa/ld199798/ldselect/ldsctech/081vii/st0701.htm](http://www.publications.parliament.uk/pa/ld199798/ldselect/ldsctech/081vii/st0701.htm).
4. European Union Conference. The Microbial Threat: The Copenhagen Recommendations. Rosdahl VK, Pedersen KB 1-52. Danish Ministry of Health and Ministry of Food, Agriculture and Fisheries, September 1998.  
[www.sum.dk/publika/micro98/](http://www.sum.dk/publika/micro98/).
5. World Health Assembly Resolution. Emerging and Other Communicable Diseases: Antimicrobial Resistance. WHA 51.16, 16 May 1998
6. Department of Health. UK Antimicrobial Resistance Strategy and Action Plan. June 2000.
7. Shlaes D, Gerding DN, Joseph JF, et al. Society for Healthcare Epidemiology of America and infectious Diseases Society of America Joint Committee on the Prevention of Antimicrobial Resistance: Guidelines for the Prevention of Antimicrobial Resistance in Hospitals. Clinical Infectious Diseases 1997; 25: 584-99.
8. Brown EM. Guidelines for Usage in hospitals. Journal of Antimicrobial Chemotherapy 2002; 49: 587-592.
9. Gould IM. A review of the role of antibiotic policies in the control of antibiotic resistance. Journal of Antimicrobial Chemotherapy 1999; 43: 459-65.
10. Davey P, Nathwani D, Rubenstein E. Antibiotic policies. In Antibiotics and Chemotherapy (Finch ,R.G;Greenwood D; Norrby. S.R; Whitley, R; Eds). Churchill Livingstone, London and Edinburgh, UK, 2003.
11. MacGowan JE. Jr Year 2000 Bugs: The End of The Antibiotic Era. Proc R Coll Physicians Edinb 2001; 31: 17-27.
12. Wiffen PJ, Mayon White RT. Encouraging good antimicrobial prescribing practice: a review of antibiotic prescribing policies used in the South East Region of England. BMC Public Health. 2001;1(1):4.

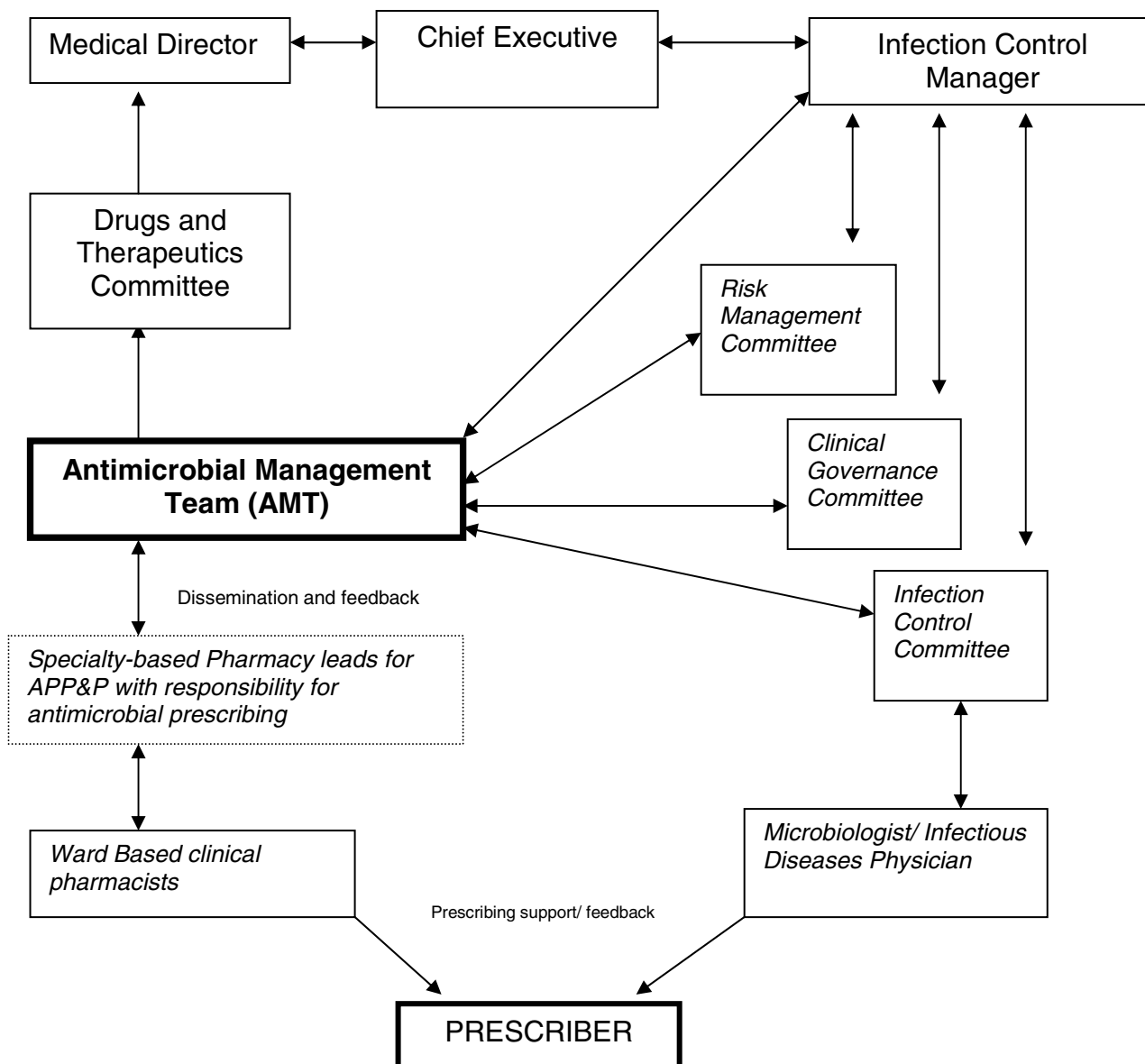
13. Scottish Intercollegiate guidelines Network (SIGN) 2000. SIGN 45: Antibiotic Prophylaxis in Surgery. Edinburgh. [www.sign.ac.uk/guidelines/fulltext/45/index.html](http://www.sign.ac.uk/guidelines/fulltext/45/index.html).
14. Nathwani D. From evidence-based guideline methodology to quality of care standards. *Journal of Antimicrobial Chemotherapy* 2003; 51: 1103-1107.
15. Good Practice Guidance for Antibiotic Prescribing in Hospital. *J R Coll Physicians Edinb* 2003; 33: 281-284.
16. How to Investigate Antimicrobial Drug Use in Hospitals: Selected Indicators. Working draft. Rational Pharmaceutical Management Plus Program, Centre for Pharmaceutical Management, Arlington, VA, USA. May 2001. [http://www.inrud.org/documents/How\\_to\\_Investigate\\_Antimicrobial\\_Drug\\_Use\\_in\\_Hospitals.pdf](http://www.inrud.org/documents/How_to_Investigate_Antimicrobial_Drug_Use_in_Hospitals.pdf)
17. Prudent Antimicrobial Prescribing: a Key Learning Objective for Tomorrow's Doctors. A Discussion paper for the working group on undergraduate medical education of the British Society for Antimicrobial Therapy. <http://www.bsac.org.uk/>.
18. Lamoth, F., Francioli, P. & Zanetti, G. 2004 Blood cultures as a surrogate marker for casemix adjustment of hospital antibiotic use. ESCMID Prague 2004.
19. Cornaglia, G. *et al.* 2004 European recommendations for antimicrobial resistance surveillance. ESCMID Study Group Report. *Clin Microbiol Infect* 10 349-383.
20. Working party report: Hospital antibiotic control measures in the UK. *Journal of Antimicrobial Chemotherapy* 1994 34 21-42.
21. Shannon, KP, French, GL. Antibiotic resistance: effect of different criteria for classifying isolates as duplicates on apparent resistance frequencies. *Journal of Antimicrobial Chemotherapy* 2002 49 201-204.
22. Shannon, KP, French, GL. Validation of the NCCLS proposal to use results only from the first isolate of a species per patient in the calculation of susceptibility frequencies. *Journal of Antimicrobial Chemotherapy* 2002 50 965-969.
23. Skoog G, Cars O, Skarlund K, et al. Large scale nationwide point prevalence study of indications for antibiotic use in 54 Swedish Hospitals in 2003. Abstract p1186. 14<sup>TH</sup> European Congress of Clinical Microbiology and Infectious Diseases, Prague 1-4 May 2004. Published in *Clinical Microbiology and Infection* 2004; 10: Supplement 3.
24. BTS Guidelines for the Management of Community Acquired Pneumonia in Adults. Pneumonia Guidelines Committee of BTS Standards of Care Committee. *Thorax* 2001; Vol 56, Supp No IV.
25. Harmony project Hospital Antibiotic Policy assessment tool. [http://www.harmony-microbe.net/antibiotic\\_prescribing\\_tool.pdf](http://www.harmony-microbe.net/antibiotic_prescribing_tool.pdf).

26. Department of Health 2003. Winning Ways: Working together to reduce Healthcare Associated Infections in England. Department of Health, London UK.
27. Department of Health 2003. Medicines Management in NHS Trusts: Hospitals Medicine Management Framework. Department of Health, London, UK.
28. Scottish Executive Health Department 2002. Preventing infections acquired while receiving healthcare: The Scottish Executive's Action plan to reduce their risk to patients, staff and visitors. SEHD, Edinburgh UK:  
[http://www.show.scot.nhs.uk/sehd/mels/HDL2002\\_82ActionPlan.pdf](http://www.show.scot.nhs.uk/sehd/mels/HDL2002_82ActionPlan.pdf)
29. Healthcare Associated Infection Task Force 2004. The NHSScotland Code of Practice for the local management of hygiene and healthcare associated infection. SEHD, Edinburgh UK: <http://www.scotland.gov.uk/library5/health/lmhhai-00.asp>
30. Specialist Advisory Committee on Antimicrobial Resistance (SACAR) 2005. UK template for hospital antimicrobial guidelines.  
[http://www.bsac.org.uk/latest\\_news.cfm?cit\\_id=413&FAArea1=customWidgets.content\\_view\\_1&usecache=false](http://www.bsac.org.uk/latest_news.cfm?cit_id=413&FAArea1=customWidgets.content_view_1&usecache=false)

### **Other Key References**

European Surveillance of Antimicrobial Chemotherapy. Interventions in Hospitals related to antibiotic use. Chair: Prof. P. Davey  
[www.uia.ac.be/esac/Workshop%205.htm](http://www.uia.ac.be/esac/Workshop%205.htm)

**FIGURE 1:  
Model Antimicrobial Prescribing Practice Pathway in Acute Hospitals**



**Note**

The above figure outlines a proposed pathway to monitor and influence antimicrobial prescribing within a hospital or health care organisation’s clinical governance structure. In particular, the multi-disciplinary AMT should be a sub group of and report to the DTC. There should also be a clear path of communication with the Infection Control Committee where there may be overlapping interests or expertise. An *Antimicrobial Pharmacist*<sup>27</sup> should take the lead in coordinating the implementation and audit of antimicrobial practice and as such the use of existing pharmacy structures is essential to support this activity; the antimicrobial pharmacist should also report to the Chief Pharmacist. Local investment is likely to be required to support the establishment of lead antimicrobial pharmacists. In some hospitals there may be specialty-based lead pharmacists who could link with ward based pharmacists.

## Appendix 1

### ANTIMICROBIAL PRESCRIBING POLICIES AND FORMULARIES

#### 1.1 Acute Hospital Prescribing Policy/Guidelines

The following are standards proposed to be met by hospitals and could form the basis for national audit.

1. An antimicrobial formulary should be in place. A recent template for hospital antimicrobial prescribing policies from SACAR may be helpful<sup>30</sup>.
2. Guidelines should be in place for antimicrobial prescribing for common clinical scenarios (e.g. community acquired pneumonia (CAP), urinary tract (UTI), skin and soft tissue, intra-abdominal, central nervous system infections and sepsis of unknown source).
3. Guidelines should include the following
  - i Choice of initial agent
  - ii Choice of route of administration
  - iii Guidelines for intravenous to oral antimicrobial switch.
4. Guidelines should be in place for surgical prophylaxis.
5. There should be an “Alert” or restricted antimicrobial policy which should incorporate the following:
  - i A list of restricted antimicrobials
  - ii Protocols for use
  - iii Monitoring of restricted antimicrobials
6. A means to quantify the usage and costs of selected antimicrobial agents should be in place (Defined daily dose)

#### 1.2 Prescribers' adherence to guidelines

The following are a list of auditable standards which should be met by prescribers:

1. Information regarding infection should be recorded in medical case notes for patients receiving intravenous or “alert” antimicrobials. This should include the following basic detail:
  - i Diagnosis (site or nature of infection)
  - ii Evidence of an assessment of severity (may include temperature, heart rate, respiratory rate, blood pressure, white cell count, CRP)
  - iii Evidence of blood cultures being performed in patients with sepsis
  - iv Name of antimicrobial prescribed.

2. Appropriate use antimicrobials for selected common infections (e.g. respiratory tract infections, UTI, wound infection):
  - i Appropriate agent(s) chosen
  - ii Appropriate route of administration (IV vs oral dependent on patient factors)
  - iii Appropriate timing of IV to oral switch
  - iv Appropriate choice of empiric oral switch agent (in absence of positive microbiology e.g. in CAP)
  - v Appropriate choice of streamlined (IV or oral) agent (in presence of positive microbiology e.g. *E.coli* or *S.aureus* bacteraemia)
3. Appropriate use (<24 hours) of antimicrobials in surgical prophylaxis

### **1.3 Feedback of information to the AMT and to prescribers**

1. Use of restricted agents:
  - i Monitoring of clinical areas where restricted agents are used
  - ii Record of indications for use
  - iii Record of breaches of protocols

- feedback to antimicrobial group quarterly (at each meeting)
2. Audit of antimicrobial use; a point-prevalence survey should be performed at least annually (preferably twice yearly) to monitor trends in prescribing. Such surveys should inform more detailed studies of prescribing practice in specific areas. Results of audits should be feedback to prescribers through the specialties.
3. Ward based pharmacists should provide concurrent patient specific feedback to prescribers.
4. Feedback to individual unit specialties of information related to antibiotic consumption should also be promoted.

## Appendix 2

### GUIDELINES IMPLEMENTATION CHECKLIST

A range of responsibilities has been identified for implementation of the APP&P recommendations. These can be summarised as follows:

#### 2.1 An appropriate national organisation

1. Develop the infrastructure to support implementation of APP&P
2. Establish a national Clinical Forum to facilitate networking across Scotland in APP&P
3. Facilitate audits of antimicrobial prescribing via national co-ordination of minimum clinical datasets to support prescribing for common infections
4. Collate and report antimicrobial utilisation trends across Scotland

#### 2.2 Chief Executive, Infection Control Manager and Clinical Governance Committee

1. Ensure local framework is in place for implementation of APP&P
2. Establish systems for implementing APP&P recommendations, supported by appropriate information technology.
3. Facilitate the appointment of a Lead Pharmacist and Lead Doctor for APP&P
4. Report antimicrobial performance indicators

#### 2.3 Lead Doctor and Lead Pharmacist

1. Establish an Antimicrobial Management Team (AMT) for APP&P.
2. Ensure the membership of the Team includes a microbiologist and/or infectious diseases physician, the Infection Control Manager (HDL(2005)8), senior medical staff representation from the specialities of medicine and surgery and any other relevant stakeholders, depending on local circumstances. The Infection Control Manager has direct links with the Chief Executive and the Clinical Governance, Risk Management and Infection Control Committees.
3. Integrate the functions of the AMT with local Drugs and Therapeutics Committees.
4. Co-ordinate hospital analysis and reporting of antimicrobial use using the ratio of WHO DDDs/occupied bed days.
5. Identify responsibility for setting APP&P standards, reporting of hospital antimicrobial use and resourcing of this activity within all acute hospitals.
6. Ensure the availability of a process for feedback of information on antimicrobial prescribing the AMT and to prescribers.
7. Report to the Chief Executive.

## **2.4 Drugs and Therapeutics Committees**

1. Establish a Formulary of approved antimicrobial therapy.
2. Co-ordinate a Register of Protocols/Policies to promote good prescribing practice for a range of prophylactic and therapeutic indications.
3. Support the activities of the AMT.
4. Receive results of antimicrobial audits, monitor adherence to guidelines, endorse relevant reports for the Clinical Governance Committee and disseminate recommendations to hospital personnel.
5. Establish clear ways of working with the Infection Control Committee.

## **2.6 Antimicrobial Management Team (AMT)**

1. Ensure that all hospitals have an Antimicrobial Policy and that all relevant policies/guidelines are reviewed annually.
2. Maintain responsibility for antimicrobial formulary management and prescribing policy, in response to national guidance and local susceptibility data.
3. Take ownership for defining skills and competencies for prudent antimicrobial prescribing, in line with national frameworks where appropriate.
4. Ensure participation in a structured postgraduate CPD programme for all professionals involved in antimicrobial prescribing or administration.
5. Ensure that guidelines are in place for prescribing of antimicrobials for surgical prophylaxis and for the treatment of common clinical infections.
6. Co-ordinate hospital systems to avoid routine reporting of susceptibility to non-formulary or restricted antimicrobial agents.
7. Promote the implementation of an "Alert" or restricted antimicrobial policy.
8. Co-ordinate the analysis and reporting of antimicrobial use in hospitals, in accordance with nationally agreed standards.
9. Define clear lines of accountability between the Chief Executive, the Lead Clinician/Pharmacist, Infection Control Manager, DTC and AMT.
10. Clarify ways of working with the DTC and Infection Control Committees.
11. Feed back information to the DTC and individual medical/surgical specialties.
12. Establish systems to audit antimicrobial practice.

## **2.7 Lead Clinician**

1. Develop professional networking between the AMT, the Medical Director, Specialists in Medicine and Surgery and all medical prescribers.

## **2.8 Lead Antibiotic Pharmacist**

1. Lead co-ordination of the implementation and audit of good antimicrobial practice.
2. Develop professional networking between AMT and specialty based lead pharmacists/ward pharmacists.
3. Report to the Divisional Chief Pharmacist.

## **2.9 Microbiology**

1. Provide clinically useful information for the clinician and epidemiological data to inform antimicrobial and infection control policies.
2. Perform susceptibility tests using appropriately rigorous methodology.
3. Avoid routine reporting of susceptibility to non-formulary or restricted antimicrobial agents.
4. Measure MICs or zone sizes for all clinically relevant bacterial isolates.
5. Support arrangements for submission of blood cultures before antimicrobial administration in all patients with possible bacteraemia.
6. Establish standard systems for flagging antibiotic resistant alerts to the infection control team.
7. Publish annual laboratory susceptibility data to inform prescribers, policies and formularies.

## **2.10 Clinical Teams**

1. Maintain responsibility for the overall management of sepsis and the infection control consequences of antimicrobial prescribing in specialist areas.
2. Make appropriate use of the laboratory to guide antimicrobial therapy.
3. Promote good practice in APP&P.

## **2.11 Clinical Practitioners**

1. Maintain responsibility for good antimicrobial prescribing policy and practice.
2. Understand the aims of the antimicrobial policy and monitoring framework.
3. Document participation in APP&P education/training in a CPD portfolio.
4. Record information regarding infection in medical case notes for patients receiving intravenous or “alert” antimicrobials.

## **2.12 Ward based pharmacists**

1. Provide immediate patient specific feedback to prescribers.

## **2.13 Deans of the University Schools of Medicine**

1. Scottish Deans Curriculum Group should consider the influence of undergraduate medical education on prudent antimicrobial prescribing.

## **2.14 Postgraduate Education Providers**

1. Acute NHS hospitals in Scotland should demonstrate a structured series of educational opportunities on antimicrobials for junior prescribers. The various Royal Colleges with NES could have a key role in the development of such educational programmes.

2. Provide regular updates on antimicrobial prescribing as part of a rolling programme of CPD for all NHS hospital personnel involved in the prescribing and administration of antimicrobials.

## Appendix 3

### GLASGOW ANTIMICROBIAL AUDIT TOOL

#### Summary Instructions for Completing the Audit

#### DATA COLLECTION FORMS

There are two data collection forms

1. **General Details Form:** ONE form should be completed for EACH WARD where you collect data.
2. **Antimicrobial Data Form** – ONE form should be completed for EACH PATIENT prescribed an antimicrobial.

#### STUDY INCLUSION/EXCLUSION CRITERIA

Data should only be collected for patients who are still prescribed antimicrobials at the time that you visit the ward.

Do **NOT** collect data on patients aged < 16 years and those antimicrobials which are prescribed for the following indications:

- antibiotics for surgical prophylaxis, urinary tract infection prophylaxis, post-splenectomy prophylaxis or any other form of prophylaxis
- antibiotics for use as a motility stimulant
- any topical antimicrobial applied to the skin, eye, ear, nasal passages or genital area for local effect
- antiretrovirals, antiprotozoal or anthelmintics preparations

#### INFORMATION ON COMPLETING THE DATA COLLECTION FORM

##### Section 1: Patient details

- The date of hospital admission should be the date the patient was **FIRST ADMITTED TO HOSPITAL** and not the date that they were admitted to the ward.
- Indicate any antimicrobial allergies have been documented on the prescription chart. The YES box should be ticked if there are allergies documented which show the patient is allergic to antimicrobials. The NO box should be ticked if there are no known allergies OR no documented allergies.
- Indicate if patient is normally resident in a nursing or residential care home. Patients normally resident in sheltered housing or accommodation for the homeless should not be included in this category.
- Indicate if treatment with an **alert antimicrobial** was discussed with a microbiologist.

##### Alert Antimicrobials

- |               |                |            |
|---------------|----------------|------------|
| - Tazocin     | - Meropenem    | - Imipenem |
| - Teicoplanin | - Linezolid    | - Abelcet  |
| - Caspofungin | - Voriconazole | - AmBisome |

## **Section 2: Antimicrobial indication**

Tick both the broad and specific indication

## **Section 3: Current antimicrobial prescribing**

Only write the drug name. The dose and frequency are not required.

## **Section 4: Initial antimicrobial prescribing**

Only write the initial antimicrobial prescribed. The dose and frequency are not required.

*SECTIONS 5, 6 AND 7 NEED ONLY BE COMPLETED FOR PATIENTS WHO ARE PRESCRIBED AN IV ANTIMICROBIAL TODAY*

## **Section 5: Indication for current IV therapy**

Use the highest value obtained in the 24 hours preceding the audit for temperature, heart rate, respiratory rate and blood pressure to tick the appropriate box. (Patient's observation chart.)

Use the last available white cell count, (blood count report) urea, (urea and electrolytes report) and PO<sub>2</sub> (blood gases report) to tick the appropriate box.

## **Section 6: Use of IV route**

Complete the information on the patient's condition in the 24 hours preceding the audit from the patient's case notes. Indications of deteriorating clinical condition might be documented as, for example, *patient remains febrile*, or *patient not improving*.

## **Section 7: Documented clinical symptoms**

Please indicate which of the clinical symptoms listed were recorded in the case notes in the 24 hours prior to or after IV antimicrobials were first prescribed.

## **WHAT TO DO IF YOU HAVE ANY QUESTIONS**

Each site will have a nominated local audit coordinator - please contact them directly if you have any questions regarding the completion of the data collection form.

## **WHAT TO DO ONCE YOU HAVE COMPLETED THE AUDIT**

Once you have completed one **GENERAL DETAILS FORM** and an **ANTIMICROBIAL DATA FORM** for each person on the ward who has been prescribed an antimicrobial, please place all forms in the folder provided and return the complete folder to the audit co-ordinator.

***Local contact number***

## General Details Form – Survey 1

You should complete one form for each ward that you visit today. Please tick the appropriate box or enter details in the space provided.

<b>Section 1 Auditor Details:</b> Please insert your details in the space below		
<b>Name:</b>		
<b>Contact details:</b>	Page no:	Telephone no:
<b>Designation:</b>	Doctor <input type="checkbox"/> Microbiologist <input type="checkbox"/> Nurse <input type="checkbox"/> Ward pharmacist <input type="checkbox"/> Other pharmacist <input type="checkbox"/> Other <input type="checkbox"/>	
<b>Section 2: Hospital</b>		
<b>GLASGOW HOSPITALS</b>		
GGH <input type="checkbox"/>	GRI <input type="checkbox"/>	SGH <input type="checkbox"/> STOB <input type="checkbox"/>
VI <input type="checkbox"/>	WIG <input type="checkbox"/>	Other (Please specify) _____
<b>OTHER HOSPITALS</b>		
Aberdeen Royal Infirmary (ARI) <input type="checkbox"/>	Ninewells (NW) <input type="checkbox"/>	
Monklands General Hospital (MGH) <input type="checkbox"/>	Perth Royal Infirmary (PRI) <input type="checkbox"/>	
i. Other (Please specify) _____		
<b>Section 3: Ward details</b>		
<b>Ward name/number:</b>		
<b>Section 4: Ward Speciality</b>		
Cardiology /CCU <input type="checkbox"/>	ENT <input type="checkbox"/>	Gastro <input type="checkbox"/>
General Medicine <input type="checkbox"/>	HDU (medical) <input type="checkbox"/>	HDU (mixed) <input type="checkbox"/>
HDU (surgical) <input type="checkbox"/>	Infectious diseases <input type="checkbox"/>	Medical Receiving <input type="checkbox"/>
Medicine for the Elderly <input type="checkbox"/>	Orthopaedics <input type="checkbox"/>	Respiratory <input type="checkbox"/>
Renal <input type="checkbox"/>	Rheumatology <input type="checkbox"/>	Stroke (Acute) <input type="checkbox"/>
Surgery general <input type="checkbox"/>	Surgical receiving <input type="checkbox"/>	Urology <input type="checkbox"/>
Vascular Surgery <input type="checkbox"/>	OHPAT <input type="checkbox"/>	Other <input type="checkbox"/>
<b>Section 5: Availability of antimicrobial guidelines</b>		
<b>Tick if any of the following are implemented. If you are unsure, please ask the ward manager.</b>		
Alert antibiotics policy	<input type="checkbox"/>	
Automatic stop policy	<input type="checkbox"/>	
Clinical handbook/Junior Doctors handbook	<input type="checkbox"/>	
IV to oral switch guidelines for medical staff	<input type="checkbox"/>	
Pharmacist/nurse initiated antibiotic IV to oral switch	<input type="checkbox"/>	
Sepsis policy	<input type="checkbox"/>	
Specific antimicrobial guidelines for the unit/ward	<input type="checkbox"/>	
Does this ward routinely receive a clinical pharmacist visit? Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/>		
<b>Section 6: Bed occupancy details</b>		
Please enter the date of data collection: _____/_____/_____		
How many beds on the ward are currently occupied? Please include all patients currently absent from the ward due to investigations. Do not include patients who are away on pass. _____		
<b>Section 7: Time to complete audit</b>		
Approximately how long did it take you to complete the audit? _____ minutes		
How many <b>patients</b> were prescribed an antimicrobial at the time of the audit?		

**Glasgow Antimicrobial Audit Tool – Antimicrobial Data Form**

**Section 1: Patient Details**

<b>Hospital:</b>	Was the patient previously discharged from any hospital in the last 28 days?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
<b>Ward:</b>	Was the patient admitted from a nursing or residential home?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
<b>Age:</b>	Is the patient a boarder?	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>Gender:</b>	Antimicrobial allergies recorded on prescription chart	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>Date of hospital admission:</b>	Has treatment with <b>alert antimicrobials</b> been discussed with a microbiologist?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>

**Section 2 Antimicrobial Indication:** tick the appropriate broad and specific indication. If you are unsure of the specific indication, or if it is not listed below, write the diagnosis as it appears in the medical notes in the space below.

<b>Broad indication:</b>	<b>Specific indication:</b>	
Respiratory <input type="checkbox"/>	Pneumonia (including LRTI) <input type="checkbox"/>	Aspiration pneumonia <input type="checkbox"/> Exac COPD <input type="checkbox"/>
	URTI <input type="checkbox"/>	Cystic fibrosis /bronchiectasis <input type="checkbox"/> TB (including ExPTB) <input type="checkbox"/>
Urinary Tract <input type="checkbox"/>	Lower UTI <input type="checkbox"/>	Pyelonephritis <input type="checkbox"/>
Skin/soft tissue <input type="checkbox"/>	Bursitis <input type="checkbox"/>	Cellulitis <input type="checkbox"/> Surgical site infection <input type="checkbox"/>
	Trauma/burn <input type="checkbox"/>	Abscess <input type="checkbox"/> Deep soft tissue <input type="checkbox"/>
Deep seated infection <input type="checkbox"/>	Bone/joint <input type="checkbox"/>	Endocarditis <input type="checkbox"/> Meningitis <input type="checkbox"/>
	Encephalitis <input type="checkbox"/>	
Abdominal/ Pelvic <input type="checkbox"/>	Hepatobiliary <input type="checkbox"/>	<i>C difficile</i> <input type="checkbox"/> <i>H pylori</i> eradication <input type="checkbox"/>
	Gastroenteritis <input type="checkbox"/>	Other <input type="checkbox"/>
Sepsis /infection source unknown <input type="checkbox"/>	Neutropenic fever <input type="checkbox"/>	Infection cause unknown <input type="checkbox"/> Mixed infection <input type="checkbox"/>
Other <input type="checkbox"/>	Notes unavailable <input type="checkbox"/>	Not documented <input type="checkbox"/> Other <input type="checkbox"/>

**Section 3: Current antimicrobial prescribing** – only record what is prescribed on the prescription chart for today

Antimicrobial	Date started	Route
	__/__/__	Oral <input type="checkbox"/> (1) IV <input type="checkbox"/> (2) Other <input type="checkbox"/>
	__/__/__	Oral <input type="checkbox"/> (1) IV <input type="checkbox"/> (2) Other <input type="checkbox"/>
	__/__/__	Oral <input type="checkbox"/> (1) IV <input type="checkbox"/> (2) Other <input type="checkbox"/>

**Section 4: Initial IV therapy:** only record initial IV antimicrobial(s) prescribed for the current infective episode

Previous IV antimicrobial	Date started	Previous IV antimicrobial	Date started
	__/__/__		__/__/__
	__/__/__		__/__/__

**SECTIONS 5, 6 AND 7 SHOULD ONLY BE COMPLETED FOR PATIENTS WHO ARE PRESCRIBED AN IV ANTIBIOTIC TODAY**

**Section 5: Indication for current IV therapy:** tick the appropriate box based on the preceding 24 hours or last available

Temperature: ≥ 38° or ≤ 36°	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>	Systolic BP: ≤ 90mmHg	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>
Heart rate: ≥ 90bpm	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>	Diastolic BP: ≤ 60mmHg	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>
Respiratory rate: ≥ 20/min	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>	Urea: ≥ 7mmol/L	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>
WBC Count: ≤ 4 or ≥ 12x10 <sup>9</sup> /L	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>	PO <sub>2</sub> : ≤ 8kPa	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Documented <input type="checkbox"/>

**Section 6: Use of IV route:** Complete the information based on the patients' condition in the preceding 24 hours

<b>Oral route compromised</b> eg ↓ swallow, ↓ absorption, vomiting, unconscious, nil by mouth	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>	<b>Deteriorating clinical condition</b>	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
<b>Patient immunosuppressed?</b>	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>	If yes, please tick the appropriate reason: Malignancy <input type="checkbox"/> HIV <input type="checkbox"/> Steroids <input type="checkbox"/> Other immunosuppressive <input type="checkbox"/>	

**Section 7: Documented clinical symptoms:** Please indicate which of the following were recorded in the case notes either 24 hours prior to or 24 hours after IV antimicrobial(s) prescribed

Clinical signs	Yes	No	Unknown	Clinical signs	Yes	No	Unknown
Chills, rigors or sweats (1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Acute confusion (4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Metabolic acidosis (2)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	New AF (5)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oligouria (3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

**For official use only**

Are sepsis criteria met? Yes  No

If no, is IV therapy indicated? Yes  No  Unknown

**PatientID**

## **Appendix 4**

### **MEMBERSHIP OF WORKING GROUP**

Professor Dilip Nathwani (Chairman), Infectious Diseases & General (Internal) Medicine, Ninewells Hospital and Medical School

Mr Scott Bryson, Pharmaceutical Adviser, Greater Glasgow NHS Board

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