



Scottish
Medicines
Consortium

Scottish Antimicrobial Prescribing Group

Progress Report for 2008-2011

March 2011

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First published March 2011

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Chairman's introduction



Dilip Nathwani | Chairman SAPG

In March 2008 the Scottish Government launched the Scottish Management of Antimicrobial Resistance Action Plan¹ (ScotMARAP). One of the key actions was initiation of the Scottish Antimicrobial Prescribing Group² (SAPG), hosted by the Scottish Medicines Consortium (SMC), to take forward national implementation of the key recommendations of ScotMARAP. SAPG held its first meeting in June 2008 and membership was fully established by October 2008. SAPG is a national clinical multidisciplinary forum with representation from stakeholders in the national and regional NHS. The primary objective of SAPG is to co-ordinate a national framework for antimicrobial stewardship to enhance the quality of antimicrobial prescribing and infection treatment in Scotland. This complements the immense efforts already being undertaken in infection prevention and environmental decontamination as part of the national strategy to combat healthcare associated infections (HAI).

At the heart of ensuring ownership and engagement from the antimicrobial prescribing community in Scotland, SAPG has successfully developed and embedded clinical antimicrobial management teams (AMTs) within NHS boards. These specialist teams are the key support for clinicians in primary and secondary care to encourage prudent prescribing. The formation of a clinical network of AMTs has been instrumental in providing SAPG with 'real world' feedback relating to antimicrobial issues. This regular two-way dialogue is helpful in informing national policy and guidance. The structure of SAPG is similar to that of its host organisation the SMC, in that SMC represents a consortium of active Area Drug and Therapeutics Committees and SAPG represents an active consortium of AMTs. AMTs engage with a broad body of prescribing clinicians and key local stakeholders such as risk management, infection prevention teams, the Scottish Patient Safety Programme, clinical governance and others.

At the inception of SAPG, Scotland, in keeping with the UK and many parts of the world, was faced with not only the considerable threat of antibiotic resistance, but also the significant burden of *Clostridium difficile* infection (CDI). This is primarily as a consequence of the unique ecological impact of often unnecessary and inappropriate antibiotic prescribing. Whereas for many years we have enjoyed the unequivocal clinical benefits of modern powerful antibiotic therapy, there is now a realisation that clinicians, organisations and the public have to learn to use this valuable resource more prudently. Otherwise the effectiveness of these drugs and their longevity will be depleted and we will continue to incur the undoubted risks described. Our stewardship interventions are based on a sound evidence base from published literature and relevant experience from the UK and internationally. Whilst key outcomes such as clinical improvement, reduction in CDI and resistance and fiscal benefits have been described, it is important to reassure clinicians that any change in prescribing will not lead to unintended harm such as worsening mortality or drug related toxicity. These concerns have informed the strategy of our work programmes which, where appropriate, have been underpinned by quality improvement methodology and NHS board level national scrutiny targets.

SAPG at its inception had a range of objectives, but the initial focus was to support measures to achieve the Scottish Government's CDI HEAT (Health, Efficiency and Access to Treatment) target for 30% reduction of CDI by March 2011 (subsequently extended to 50% in June 2010). The use of prescribing indicators as national targets to support this overarching goal appears to have been successful.

During the first 3 years, a system of five work streams: Organisation, Information, Education, Infection Management and Community Acquired Pneumonia has been used to deliver our action plan and the key achievements from these work streams are summarised in this report.

Our aim has been to engage and support local clinicians and NHS boards to regularly collect and share information relating to the quantity and quality of prescribing and infection treatment areas to support improvement in prescribing. These data provide SAPG and others with national trends in resistance to inform policy. The implementation of good practice guidance has been supported by educational programmes and improvement methodology where appropriate.

We recognise that our work streams have delivered a range of outcomes over a short to medium time frame. However, it is critical SAPG is responsive to any unforeseen immediate challenge whilst also importantly providing a longer term vision for stewardship in Scotland. From 2011 to 2014 SAPG plans to undertake actions which are aligned with the HAI Task Force Delivery Plan 2011-2014 and will support NHS boards and frontline clinical staff to enhance the quality of antimicrobial prescribing to deliver safe, effective person-centred care as described in the Healthcare Quality Strategy. This will ensure that we provide Scotland with a high quality and fit for purpose national stewardship programme for at least the next decade and beyond. Good stewardship is and will significantly contribute to the HAI agenda and will preserve or increase the longevity of the effectiveness of antibiotics. I hope that the publication of this report will not only fulfil one of our objectives of sharing our experiences and work with the NHSScotland community but encourage collaborations by fostering links with other national programmes.

I am extremely grateful for all the members of SAPG, its key stakeholders and above all the AMTs for their dedication and enthusiasm in helping us take forward this project. Our journey has just begun, we are encouraged by our early efforts and success but we have much to do and learn from each other.



Dilip Nathwani
Chairman SAPG

Executive summary

The Scottish Antimicrobial Prescribing Group (SAPG) has been established as a national clinical forum to lead the first national initiative to actively address antimicrobial stewardship.

Membership was established in 2008 and key staff appointed (Appendix 1). SAPG now meets every 2 months and a Project Board provides clinical and financial governance.

We have recently refreshed our membership so that each NHS board Antimicrobial Management Team (AMT) is represented to ensure ownership and facilitate implementation of our guidance. The membership will also reflect greater emphasis on primary care and working closely with specialist teams such as surgeons and acute care physicians.

SAPG developed five work streams to take forward various aspects of ScotMARAP, each with a work plan and defined timescales - key achievements of each work stream are described within this report.

SAPG hosts regular national AMT network events to communicate our work and provide peer support opportunities for AMT members throughout Scotland (Appendix 2).

In addition to AMT events, communication of our work at national and international meetings is important to demonstrate that our national model for improvement is effective. SAPG has submitted several poster presentations to conferences, the Chair and other members have presented on SAPG at international conferences and have published several articles (Appendix 3).

Collaboration with key stakeholders at national and NHS board level has been essential to develop national consensus on key issues within antimicrobial stewardship.

Figure 1 below shows the key national and local stakeholders that SAPG collaborate with. National stakeholders are shown in blue and local stakeholders in red.

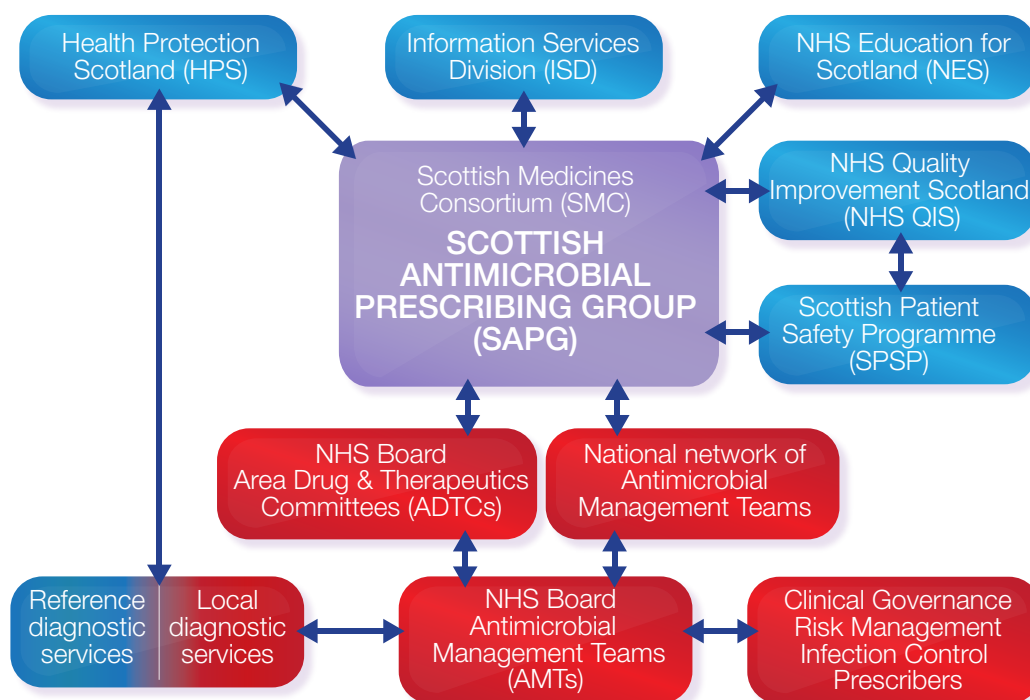


Figure 1: SAPG stakeholders

SAPG collaborates at both national and international level with other organisations working on infection management and quality improvement.

SAPG has been working with the Scottish Patient Safety Programme³ (SPSP) to integrate quality improvement initiatives to optimise antibiotic use and management of common infections in hospitals with SPSP work and with Health Protection Scotland (HPS) to utilise and further develop current datasets for surgical site infection (SSI).

The Scottish National Audit Project – Community Acquired Pneumonia (SNAP-CAP) was taken over by SAPG as an exemplar quality improvement model for infection management to embed this methodology within NHS boards. A care bundle for CAP is promoted in all boards as best practice in managing severe pneumonia.

SAPG has contributed expertise in antimicrobial use and data management to a Scottish Government programme to develop and implement standards for management of neutropenic sepsis.

The model for the structure of SAPG and AMTs was based on Strama⁴ (Swedish strategic programme against antibiotic resistance) which was initiated in 1995. In October 2009, a delegation from SAPG visited the central office of Strama in Stockholm and a regional Strama centre in Växjö, Kronoberg County, to discuss current activities, successes and challenges.

The Welsh Antimicrobial Resistance Programme⁵, established in 2005, has similar aims to SAPG and we have undertaken reciprocal visits to discuss how national prescribing and surveillance data are collected and evaluated.

SAPG and AMTs have contributed to the 43% reduction in *Clostridium difficile* infection (CDI) seen throughout NHSScotland by national restriction of antimicrobials associated with a high risk of CDI.

National primary care prescribing data and local hospital antimicrobial use data show that use of high risk antimicrobials has decreased in all NHS boards.

Development and measurement of hospital prescribing indicators to support the CDI HEAT target for reduction of CDI has shown that prescribers are complying with restricted policies.

National compliance with the empirical prescribing indicator is currently 82% and significant progress has been made with the primary care indicator on seasonal variation in quinolone use with nine NHS boards now below the target.

There is a temporal association between the introduction of restrictive antimicrobial policies in line with SAPG guidance and the declining rates of CDI in Scotland. By using time series analysis we have started to quantify the true impact of these national interventions separately from other infection control measures. Local data from one region (NHS Tayside) suggests a strong link between the implementation of a restrictive policy and local reduction of 12 CDI cases per month⁷. These changes in prescribing practice have also made a significant financial impact on cost avoidance due to reduced CDI (estimated as > £7 million) and reduced antimicrobial spend (estimated as £3 million) for the period 2009-2011.

SAPG is committed to ensuring that these significant gains are improved or maintained throughout all Scottish healthcare settings.

SAPG, through collaboration with NHS National Services Scotland, has developed information systems and a surveillance framework to provide national and local data on antimicrobial prescribing and antimicrobial resistance.

Prescribing indicators for primary care have been developed to provide NHS boards with an overview of quantity and quality of antimicrobial prescribing. Comprehensive information about antimicrobial prescribing in hospitals has been developed utilising the Hospital Medicines Utilisation Database (HMUD) and local pharmacy systems.

36 hospitals across Scotland participated in a European point prevalence study of antimicrobial prescribing to provide SAPG and AMTs with baseline information on how antimicrobials are being used to identify areas for improvement.

Antimicrobial susceptibility testing of blood cultures in laboratories across Scotland has been standardised by the implementation of VITEK 2 systems (an automated identification and antimicrobial susceptibility testing system). This is an essential step in ensuring that NHSScotland is prepared for identifying emerging resistant organisms such as carbapenemases.

SAPG, in collaboration with NHS Education for Scotland (NES), has developed education and training materials to support healthcare professionals deliver antimicrobial stewardship.

The Doctors On-line Training System (DOTS) for foundation training doctors in Scotland has been revised to highlight current issues. Primary care modules have been added to the resource and access has been widened to other healthcare professionals.

An induction training pack has been developed to provide comprehensive training and supported learning on antimicrobial stewardship for all new professional staff.

Antimicrobial prescribing has been integrated into the medical undergraduate curriculum of Scottish medical schools.

National training for pharmacists has been developed and delivered.

E-learning packages for healthcare staff on *Clostridium difficile* and bacterial resistance have been launched.

Next steps for SAPG

The following actions, aligned with the HAI Task Force Delivery Plan 2011-2014, will support NHS boards and frontline clinical staff to enhance the quality of antimicrobial prescribing to deliver safe, effective, person-centred care.

- Integration of core SAPG work with key local, national and international stakeholders working in HAI and quality improvement at both strategic and operational levels to ensure a cohesive local approach to further develop and use the quality improvement experience of clinical staff working in these areas.
- Maintenance of existing stewardship activities including robust information and surveillance systems to measure prescribing and its impact on resistance and unintended consequences and education of healthcare staff.
- Further development of antimicrobial stewardship activities in primary care to improve prescribing practice in the community and long term care facility settings.
- Application of quality improvement methodology to clinical priority areas. New quality improvement work will include development of an antibiotic review bundle (to ensure better use of antibiotics in continuing care facilities) and management of urinary tract infection, particularly in relation to catheters. The latter offers an opportunity to take forward this work jointly in the primary and secondary healthcare setting.
- Development and promotion of an evidence base for antimicrobial stewardship interventions and antimicrobial resistance. Continuation of time series analyses to evaluate the effects of changes in antibiotic policy at a national level using data on antibiotic prescribing, CDI rates and mortality. This will be the first national study of its type and will allow us to gain sustainable expertise in an innovative statistical approach which is recognised as a robust and evidence-based methodology for analysing the impact of a range of healthcare interventions.

Work Stream Updates

Organisation Work Stream

This work, led by the NHS Quality Improvement Scotland (NHS QIS) Healthcare Associated Infection Team, involves working with NHS boards to ensure that essential organisational and accountability infrastructures relevant to antimicrobial stewardship are in place.

A self-assessment questionnaire was developed and completed by all NHS boards in December 2008 to establish a baseline position for antimicrobial stewardship within each board. This survey concluded that all NHS boards now have an established AMT (of varying composition and activity) and all have an Antimicrobial Pharmacist or specialist pharmacist input. All AMT report to the NHS board Medical Director and the Area Drug and Therapeutics Committee but links with other key groups such as Infection Control Committee and Clinical Governance/Risk Management vary.

A major piece of work has been to integrate antimicrobial stewardship into the Healthcare Environment Inspectorate (HEI)⁸ process. SAPG has input to the Inspectorate's initial online self-assessment, based on the Healthcare Associated Infection (HAI) Standards, development of inspection tools and training for inspectorate on antimicrobial management. In relation to stewardship the results of inspections in acute hospitals have been generally favourable which has confirmed good progress with the implementation of key structures and leadership within organisations as well as a good level of implementation of SAPG guidance, policies and educational initiatives.

A programme for Infection Implementation and Improvement (iiiP) has been developed within the NHS QIS HAI Improvement & Implementation Support Team. The aim of the programme is to develop the capacity and capability of Infection and Prevention Control Teams in improvement methodologies to support frontline staff with sustained and reliable implementation of core HAI policies and guidance. Antimicrobial prescribing has been identified as one of four key areas for improvement work within this programme.

Next steps

- Ongoing collaboration with the inspectorate on antimicrobial issues including regular meetings with the Chief Inspector to discuss current priorities.
- Quality improvement work on *Staphylococcus aureus* bacteraemias (SAB) to help NHS boards achieve the HEAT target reduction. Specific work for SAPG will be development of an algorithm for management of SAB in collaboration with microbiology colleagues to address variation in practice and reduce readmissions. This work will be done within the new Quality Improvement Work Stream (see p.22).

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Information Work Stream

This work, led by NHS National Services Scotland, Health Protection Scotland (HPS) and Information Services Division (ISD), involves the development of systems for the collection, analysis and reporting of information relating to antimicrobial resistance and prescribing in all healthcare settings.

A key objective is to align the surveillance of antimicrobial prescribing and resistance activity at local and national level to support AMT and frontline staff by enabling local access to standardised information that is relevant to their own practice, ward or clinical area across NHS boards in Scotland.

In order to support the co-ordination of activities at local level, guidance for AMT on surveillance of antimicrobial use and resistance was issued in 2010. It provides a framework for national and local surveillance systems and defines a number of areas where surveillance systems and communication structures are expected to be in place or developed within the near future.

Results of the first two year's of national surveillance of antimicrobial use and resistance were published in the 'SAPG Report on Antimicrobial Use and Resistance in Humans in 2009' available at www.scottishmedicines.org.uk/SAPG/Information.

Information on antimicrobial prescribing

In 2007 the European Surveillance of Antimicrobial Consumption (ESAC) network proposed a set of quality indicators for primary care antibacterial use. A major achievement in 2008-2009 was after consultation with AMT and other stakeholders SAPG developed a set of 51 national prescribing indicators on primary care use of antibacterials based on ESAC recommendations. The national prescribing indicators are accessible as standard reports within the web-based Prescribing Information System for Scotland (PRISMS). Prescribing indicators are objective measurements that are used to monitor use of antibacterials over time, between geographical areas and against national averages. These indicators are intended to support AMT and frontline health care professionals by making data accessible that provide an overview of antimicrobial use and enables AMT to identify areas for detailed local analysis and discussion with prescribers to support improvement in prescribing practice. A report showing the key indicators focusing on the initial SAPG priority areas is available at www.scottishmedicines.org.uk/SAPG/Information.

One of the main national prescribing indicators measures the overall use of antibacterials. In 2009 the overall use of systemic antibacterials expressed as number of prescription items per 1000 population per day (items/1000/day) was 1.6% lower than in 2008 and represents a reduction of 44,500 prescriptions. This reduction, though small, reverses the trend of annual increases observed since 2004. It remains to be seen whether this is the start of a new trend.

In 2009 SAPG adopted the Health Protection Agency (HPA) Management of Infection Guidance for Primary Care as guidance to support the development of local NHS board prescribing policies. It aims to restrict the use of antibacterials such as fluoroquinolones, cephalosporins, clindamycin and co-amoxiclav that are known to increase the risk of CDI and to promote the use of narrow spectrum antibacterials. Table 1 illustrates the key national prescribing indicators for 2009 compared with 2008.

Prescribing indicators	% change between 2008 and 2009 (items/1000/day)
Antibacterials associated with a higher risk of CDI (co-amoxiclav, fluoroquinolones, cephalosporins and clindamycin)	-19.5%
SAPG recommended antibacterials (amoxicillin, doxycycline, clarithromycin, erythromycin, flucloxacillin, phenoxymethylpenicillin, nitrofurantoin and trimethoprim)	4.9%

Table 1: Primary care prescribing indicators

The 2009 data show that progress has been made in almost all NHS boards toward reduction in the use of high risk antibacterials. Specifically the use of penicillin combinations (mainly co-amoxiclav) was 14.7% lower (items/1000/day) in 2009 than in 2008, which is the largest annual reduction since 1999. Use of fluoroquinolones was 7.1% lower in 2009 than in 2008, representing the first annual reduction since 2002 and there was also a 21.2% reduction in the use of cephalosporins over the same period. These data may be an early indication of the positive impact that SAPG and AMT are having on antimicrobial use in Scotland. The challenge will be to sustain and build on this initial improvement.

A priority area for Scottish Government and SAPG is reducing CDI. A letter issued to NHS board Chief Executives CEL 11(2009) in April 2009 announced a HEAT target for CDI defined as a reduction in the rate of CDI among people aged 65 years and above by at least 30% by 31 March 2011 (increased to 50% in June 2010). The Scottish Government and SAPG agreed three supporting antimicrobial prescribing indicators to underpin this HEAT target (see section on HEAT target prescribing indicators for further details). The primary care indicator agreed by SAPG was based on recommendations by ESAC and Scottish data suggested variation between NHS boards. The indicator adopted is that seasonal variation in use of fluoroquinolones which should be no more than 5% greater in the winter quarters compared to the preceding summer quarters. Fluoroquinolones are antibiotics which have been associated with an increased risk of CDI and are not recommended for use within primary care, except for a few specific infections. Excess usage during the winter months suggests inappropriate use for respiratory infections. This prescribing indicator is accessible to NHS boards as a standard report in PRISMS. Figure 2 shows annual percentage seasonal variation in the use of fluoroquinolones, expressed as number of defined daily doses (DDD) per 1000 population per day.



Figure 2: NHS Scotland use of fluoroquinolones in primary care, percent seasonal variation DDD/1000/day 2005-2009

This illustrates that at national level progress has been made toward the target of no more than 5% seasonal variation. In 2009 the target has been met for the first time. This may reflect the impact of initiatives led by AMTs to reduce inappropriate use of fluoroquinolones since the introduction of this target. The negative seasonal variation means there was a lower use in the winter of 2009 compared with the previous summer. With ongoing work to reduce use of fluoroquinolones this effect is expected to disappear in future years.

At the outset of SAPG, national standardised information on antimicrobial use in hospitals was not available. To establish national prevalence and to identify a range of qualitative aspects of antimicrobial use in hospital, SAPG co-ordinated national participation in the ESAC 2009 point prevalence survey (PPS) of antimicrobial use in European hospitals. ESAC generally has participation from one or two hospitals per country but through promotion to AMTs and securing the support of senior NHS managers and clinicians, 31 Scottish hospitals participated. SAPG also provided support for data entry where this was not possible at local level.

SAPG produced a national report comparing the results in Scotland with European data. This was disseminated to all AMT to enable participating hospitals to compare their local results against the national findings. The report is available at www.scottishmedicines.org.uk/SAPG/Information.

The survey, conducted in May and June 2009, reviewed 8,732 patients. The national prevalence of antimicrobial use was 27.8%. The results demonstrated a lower use of antimicrobials associated with higher risk of CDI in Scotland compared to participating European hospitals. A number of areas for improvement were identified as illustrated in Table 2.

Measure	Scotland (%)	Europe (%)
Reason for use recorded in notes	76.1	71.5
Compliance with local guidelines	57.9	54.5
Surgical prophylaxis for 24 hours or less	69.7	35.0

Table 2: Scotland and Europe comparison of key measures of hospital prescribing, ESAC PPS 2009

The results have provided useful baseline information on the quality of prescribing within participating hospitals and have allowed SAPG and AMT to take forward the priorities for quality improvement in antimicrobial use in the hospital setting across Scotland.

To complement the information on primary care use of antibacterials in PRISMS, SAPG has developed a series of 48 reports presenting standardised quantitative information on hospital use of antimicrobials. These are accessible via the web-based Hospital Medicines Utilisation Database (HMUD) maintained by ISD. This system collects information from individual hospital pharmacy systems and presents standardised information at NHS board and national level. As with primary care, no single measure of use of antimicrobials in hospital can provide a comprehensive picture of utilisation of antimicrobials and so a broad range of standard reports have been produced. They are intended for use by AMTs where they will provide a broad overview of the use of all antimicrobials used in a hospital setting. This information will form the basis for AMTs to undertake more detailed analysis of particular prescribing patterns at local level.

Information on antimicrobial resistance

Another key activity within the information work stream is the Scottish surveillance programme for monitoring antimicrobial resistance in clinically important pathogens. The aim is to preserve the effectiveness of currently available antimicrobial medicines by supporting NHS boards in their long-term strategic planning of antimicrobial prescribing and infection control policies. The surveillance programme will also help to identify new emerging patterns of resistance and is modelled on the EARSS¹⁰ (European Antimicrobial Resistance Surveillance System). In this initial phase the focus is on monitoring antimicrobial resistance in invasive isolates from hospital patients with bloodstream infections (caused by *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Enterococcus faecium* and *faecalis*). In 2010 the national surveillance programme went into its second year, where data collection procedures were further consolidated and expanded by the inclusion of reports on invasive *Acinetobacter baumannii*.

The second joint annual report on antimicrobial use and resistance, published in January 2011, highlighted that resistance towards most clinically important classes of antibiotics in Gram-negative invasive isolates had stabilised or even decreased (as seen for third generation cephalosporin resistance in *E. coli*, Figure 3). It is interesting to speculate whether the effective restriction of cephalosporins in Scotland could be associated with this observed downward trend.

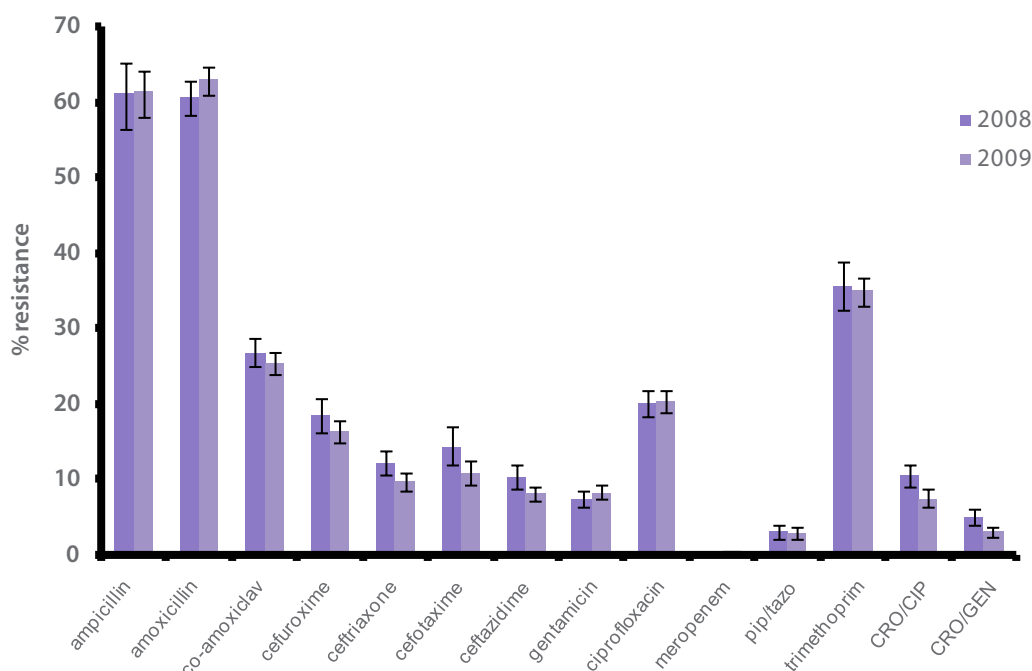


Figure 3: Antimicrobial resistance in *E. coli* isolated from blood cultures in 2008 (n=2499) and 2009 (n=3486).

Note: One isolate was resistant to meropenem in 2009 (0.04%).

Reductions in resistance frequencies for ceftriaxone, cefotaxime and ceftazidime were all statistically significant.

A major achievement in 2009–2010 was the standardisation and automation of antimicrobial susceptibility testing (AST) of blood cultures, which was achieved through the Scottish Microbiology Forum, by the implementation of VITEK 2 systems (an automated identification and antimicrobial susceptibility testing system) in laboratories across Scotland. The VITEK 2 system provides high-quality and comprehensive comparable antimicrobial resistance information for all NHS boards in Scotland that will allow detailed analysis of resistance trends and emerging new resistances at national level. Laboratories are currently expanding their use of VITEK 2 to also use it for testing urines, sputum and other types of specimens. The development of a solid IT-infrastructure for reporting surveillance data from the laboratories to HPS was a key priority in 2010. This has enabled fully automated reporting of high-quality resistance data to HPS in all NHS boards.

Since the national surveillance programme for antimicrobial resistance monitors yearly trends, it may not pick up new emerging clinical resistance problems in real-time. A national electronic 'AMR-alert system', which can detect rare pathogen-resistance combinations, was therefore introduced by HPS in 2010. This system allows identification of rare resistant pathogens that can cause serious clinical problems in real-time to ensure appropriate follow-up and containment. Timely national alerts on rare resistant pathogens will help raise awareness among prescribers and other clinical staff.

A health impact assessment of antimicrobial resistance was undertaken by HPS in collaboration with the Scottish Microbiology Forum which will help inform priorities for surveillance and interventions to prevent emergence and spread.

Next steps

- We will continue to develop information resources to support AMTs and clinicians by providing an enhanced understanding of antimicrobial use and resistance across all healthcare sectors in Scotland.
- A national pilot of a tool to support local clinicians in primary care to collect qualitative information on the primary care use of antibacterials in the management of commonly encountered infections is under way. This is intended to test the utility of the data collection tool in providing individual prescribers, AMT and SAPG with detailed qualitative information on the way in which antibacterials are used in primary care. The information will enable local and national identification of areas for quality improvement.
- Through the Scottish Government's e-Pharmacy programme implementation, primary care prescriptions will contain details of an individual's Community Health Index (CHI) number. This will enrich the prescribing information held at national level and for the first time will enable analysis of use of antibacterials in primary care by factors such as age, gender and deprivation category. This will provide information to enable a deeper understanding of antimicrobial use and will support refinement of targets for quality improvement.
- In relation to antimicrobial resistance, the surveillance programme will be expanded to include more clinically important pathogens and other types of clinical isolates such as urinary tract and respiratory isolates including isolates originating from patients in the community. Antimicrobial resistance in more superficial infections is often a precursor of evolving resistance in blood isolates. Furthermore, monitoring of multidrug resistant organisms in clinically important pathogens will be further developed in line with ECDC recommendations.
- A key priority is the development of an Antimicrobial Management Information Database for Scotland (AMIDS). Currently ISD prescribing information is obtained from PRISMS for primary care data and from HMUD for hospital data. The information on antimicrobial resistance is obtained from the HPS Electronic Communication of Surveillance in Scotland (ECOSS) database. AMIDS will allow authorised users to access the three data sources via a web-based platform and will enable analysis of combined information on antimicrobial use and resistance in order to explore the relationship between trends in use of antimicrobials and the development of antimicrobial resistance and CDI.
- As a further priority we will develop a framework for integrated national and local surveillance of unintended consequences as balancing measures that may occur directly or indirectly as a result of changes in antimicrobial prescribing and implementation of antimicrobial stewardship programmes. This framework will be based on likely markers of unintended consequences that can be monitored for trends and act as an early warning system or reassurance with respect to changed patterns of antimicrobial use.

- The framework will divide 'unintended consequences' into three categories:
 - > **Antimicrobial resistance surveillance:** Changes in antibacterial prescribing patterns (including loss of diversity in prescribing) will alter selection pressures on certain microbes. This may promote the development of resistance to the newly introduced medicines/regimens.
 - > **Efficacy of antimicrobial treatment regimens:** Substitution of an established clinically effective medicine/regimen for the treatment of bacterial infection with another medicine/regimen may be associated with, or raise concerns about the risk of an inferior clinical response, increase frequency of treatment failure and increase in infection-related mortality. Additionally, fear of toxicity with changing medicines/regimens may lead to omission of a recommended agent leaving a less effective treatment regimen.
 - > **Antimicrobial related toxicity:** Increased use of a certain medicine with a known toxicity profile can be anticipated to result in an increase in toxicity.

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William Malcolm, Pharmaceutical Adviser, HPS

Tracey Cromwell, Information Analyst, ISD

Anne Eastaway, Consultant Microbiologist, HPS

Camilla Wiuff, Epidemiologist & AMR Programme Manager, HPS

Education Work Stream

This work, led by NHS Education for Scotland (NES), has involved scoping and development of training materials on antimicrobial stewardship for both undergraduate and postgraduate healthcare professionals.

A multidisciplinary Education Advisory Sub-group has been established to take forward this work utilising professionals from primary and secondary care.

A framework of learning outcomes for antimicrobial stewardship which align with 'The Scottish Doctor' has been developed after broad consultation and is being integrated into the curricula of the five Scottish Medical Schools. The framework has also been evaluated by the two Schools of Pharmacy in Scotland to confirm that those learning outcomes applicable to pharmacists are covered by their undergraduate curricula.

The Prudent Antibiotic Prescribing for Foundation Year Doctors programme within DOTS (Doctors On-line Training System) has been revised to align with current practice and provide additional training on use of gentamicin and vancomycin. An evaluation of DOTS carried out by NES in 2007 revealed a high level of participation and satisfaction among Scottish foundation doctors. The August 2009 cohort of doctors was the first to undertake the revised programme. Access to the DOTS programme has recently been extended to allow other medical staff, pharmacists and non-medical prescribers to undertake the training and a primary care module has also been added.

A major piece of work has been the development and delivery of comprehensive training on antimicrobials for pharmacists. Three bespoke sessions for Antimicrobial Pharmacists were held during the first part of 2009 and a multi-professional conference held in October 2009 was attended by over 100 delegates including pharmacists, non-medical prescribers and infection control nurses. A continuing professional development pack on 'Pharmaceutical Care of Patients with Infections' was developed in collaboration with the Association of Scottish Antimicrobial Pharmacists and delivered nationally at local events to over 800 community and hospital pharmacists during November 2009 to March 2010.

A training pack on 'Use of antimicrobials in clinical practice' was developed and launched in 2010 to address variation between NHS boards in training provision on antimicrobial stewardship. This provides AMT with materials for training practitioners in safe and effective use of antimicrobials in hospital and primary care and addresses the continuing professional development needs of recently qualified doctors, nurses and pharmacists.

Two online learning packages were launched on the NES HAI portal¹¹ in 2009 providing background information and case scenarios on *Clostridium difficile* and bacterial resistance.

A review in 2010 showed that 1,148 learners had completed the CDI tutorial. In one NHS board all consultants were mandated to complete it and 94% of them considered the tutorial to be useful in terms of impacting on their clinical practice. 322 learners have completed the more recently available bacterial resistance tutorial and 98% stated its relevance to their clinical practice. A further online learning package on colonisation will be launched in 2011.

Next steps

- The learning outcomes framework developed for medical students will be adapted and integrated into postgraduate nursing curricula.
- NES will continue to monitor uptake and feedback evaluation of online learning packages as well as ensuring all educational resources are reviewed and updated as required.
- For senior clinical staff, with the support of the Scottish Royal Colleges Academies, we are planning a range of focused educational activity to support their learning needs.

Helen Maitland, HAI Programme Director, NES

Arlene Brailey, Assistant Director of Pharmacy, NES

Infection Management Work Stream

This work, led by SAPG clinicians, has focused on development of a national approach to Antimicrobial Prescribing Policies, quality indicators for prescribing in all healthcare settings and clinical audit of infection management.

This work stream is supported by a variety of healthcare professionals from around Scotland and several sub-groups have been established to lead on topics including Primary Care, Surgical Prophylaxis, Nursing Homes, and Public Campaigns.

Antibiotic policies

National reduction of the use of antibiotics associated with a high risk of CDI was an initial priority for SAPG. Our first guidance document was issued in July 2008 and this was followed up with 'Hospital antibiotic management: minimum requirements for antimicrobial prescribing policies'¹² in December 2008 and 'Antibiotic prophylaxis in surgery'¹³ in July 2009. All NHS boards have now reviewed their hospital antibiotic policies to ensure that the use of 'C. diffogenic' agents such as cephalosporins, co-amoxiclav, clindamycin and ciprofloxacin are restricted both for treatment of infections and in surgical prophylaxis. National consensus guidance was also developed and implemented to reduce variation around the use and monitoring of key antibiotics, vancomycin and gentamicin,¹⁴ because these agents featured significantly in the new hospital antibiotic policies. This guidance was developed in collaboration with local pharmacokinetics experts and taking into account local and national antibiotic susceptibility data for the relevant pathogens. Successful and widespread local adoption and implementation has been reported via our regular surveys to AMTs and confirmed via the HEI process.

Implementation of these antimicrobial stewardship measures to reduce the burden of CDI has been staggered with some NHS boards acting as early adopters and implementers of our guidance. We are in the process of measuring the impact of these measures nationally but some early analysis of data from NHS Tayside has shown a temporal association between changes in antimicrobial policy and reduced CDI rates⁷.

Figures 4 and 5 show the reduction in use of antibiotics associated with CDI after introduction of the new policy and the resultant impact on CDI rates using a time series model.

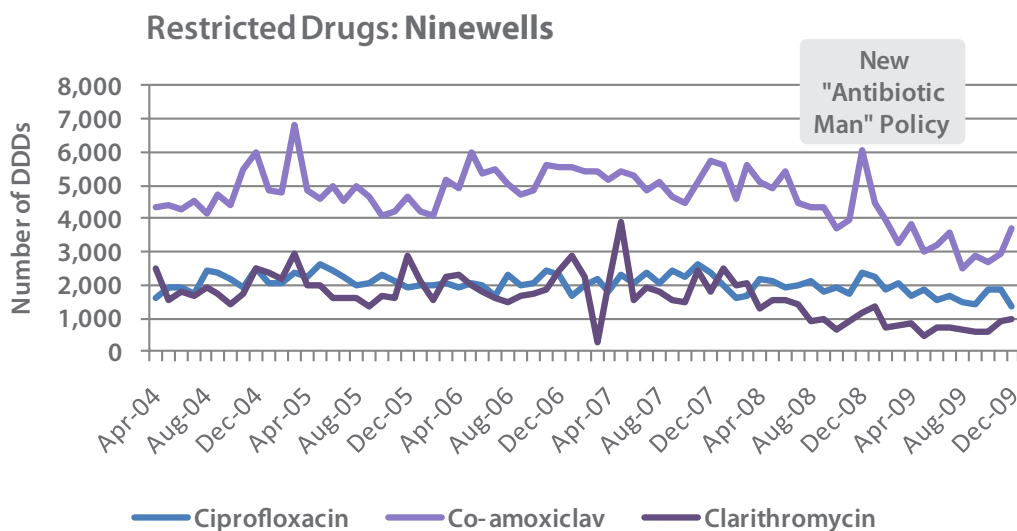


Figure 4: Use of antimicrobials targeted for restriction in new policy.

C. Diff transfer function model, R2 = 71%

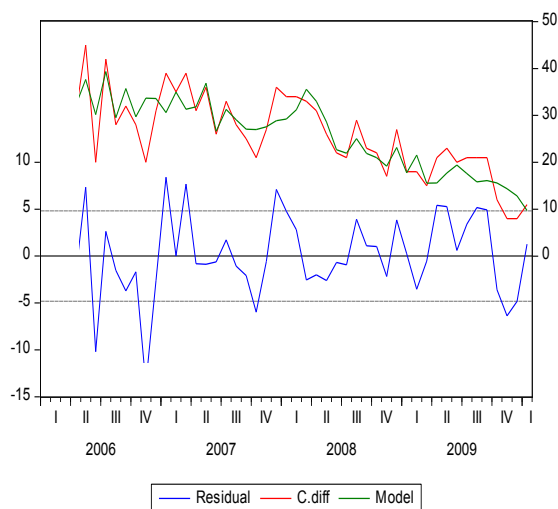


Figure 5: Time Series Model of Antibiotic Associated & Residual Cases of *C. difficile* in NHS Tayside

Similarly, guidance on management of infections in primary care based on the Health Protection Agency template¹⁵ and recommending restriction of 'C. diffogenic' agents has been adopted within all NHS boards with implementation supported by prescribing advisers and primary care pharmacists working closely with antimicrobial management teams and GPs. A range of indicators have been developed to measure the impact of implementation of primary care guidance and discussed previously in the Information Work Stream section.

Next steps

- The effects of the introduction of restricted antibiotic policies will be evaluated in all NHS boards to assess the effects on CDI, resistance rates and unintended consequences. A recent survey has provided information about local audit and surveillance activities and this will be collated and shared with Antimicrobial Management Teams (AMTs) to support development of a national strategy and local action plans to evaluate both the positive and negative impacts of our interventions.
- Collaborative research and quality improvement programme with the University of Strathclyde is under way to determine how the new gentamicin and vancomycin policies have been implemented, their impact on improving safety and efficacy, and evidence of potential unintended consequences of renal and ototoxicity.

HEAT target prescribing indicators

In 2008 Scottish Government announced a HEAT target of 30% reduction in CDI by March 2011. This target was increased to 50% in June 2010. SAPG was asked to develop national prescribing indicators for antimicrobial use in hospital and primary care that would underpin this HEAT target and contribute to reduction of CDI. Following wide consultation with AMTs and other stakeholders three indicators were agreed with the Scottish Government Health Directorate HAI team and these were announced in a Chief Executive letter in April 2009⁹. These indicators are based on compliance with local antibiotic policies which indirectly provides assurance that antibiotics associated with CDI are not used inappropriately. Details of the indicators are shown in table 3:

- **Empirical Prescribing in hospital:** Indication for treatment with an antibiotic is recorded in patient medical record and antibiotic choice is compliant with the local Antimicrobial Prescribing Policy – target $\geq 95\%$
- **Surgical prophylaxis:** Duration of surgical antibiotic prophylaxis is <24 hours and compliant with local Antimicrobial Prescribing Policy – target $\geq 95\%$
- **Primary care prescribing:** Seasonal variation in quinolone use calculated using the equation: $(\text{Oct-Mar total DDDs} / \text{Apr-Sep total DDDs} - 1) \times 100\%$ Consumption of quinolones in winter months is $\leq 5\%$ greater than consumption in summer months.

DDD = Defined Daily Dose (as defined by World Health Organisation)

Table 3: Prescribing indicators to support the CDI HEAT target

The primary care indicator is one of the series of indicators developed within PRISMS (see Information Work Stream section for further details).

Methods for data collection in hospital admission units (Indicator 1) and surgical wards/theatres (Indicator 2) were agreed and a web-based system developed for data analysis and reporting. The Institute for Healthcare Improvement¹⁶ is an American not-for-profit organisation which hosts a web-based Extranet which can be used to record, analyse and report quality improvement data. The system is used by the Scottish Patient Safety Programme and was already in use for the Community Acquired Pneumonia (SNAP-CAP¹⁷) Work Stream of SAPG. Development of the SNAP-CAP site to become the SAPG site was carried out to allow data management for the CDI HEAT target hospital prescribing indicators.

Compliance with the empirical prescribing indicator has shown a general improvement in compliance with policy and recording in the notes with current overall compliance at 79%. However, the improvement is not consistent and reliable across all areas. To achieve a higher level of compliance SAPG will support organisational and systems change through the existing quality improvement structures within NHS boards. Reports on this indicator are produced every 3 months and shared with Scottish Government and AMTs. AMTs can also access real-time data for the indicators to facilitate timely feedback to clinical staff and identify areas for quality improvement.

National data for the two elements of the empirical prescribing indicator is shown in figures 6 and 7. By December 2010 two NHS Boards achieved the target of $\geq 95\%$ compliance with the measure antibiotics compliant with empirical prescribing policy. Median compliance ranges from 65% to 88%. By December 2010 three NHS boards were achieving the target of $\geq 95\%$ compliance with the measure indication for antibiotic treatment documented in the notes. Median compliance ranges from 87% to 97%. However no NHS board achieved the target of $\geq 95\%$ compliance with the combined measure antibiotics compliant with policy and indication documented so further work on improvement is required.

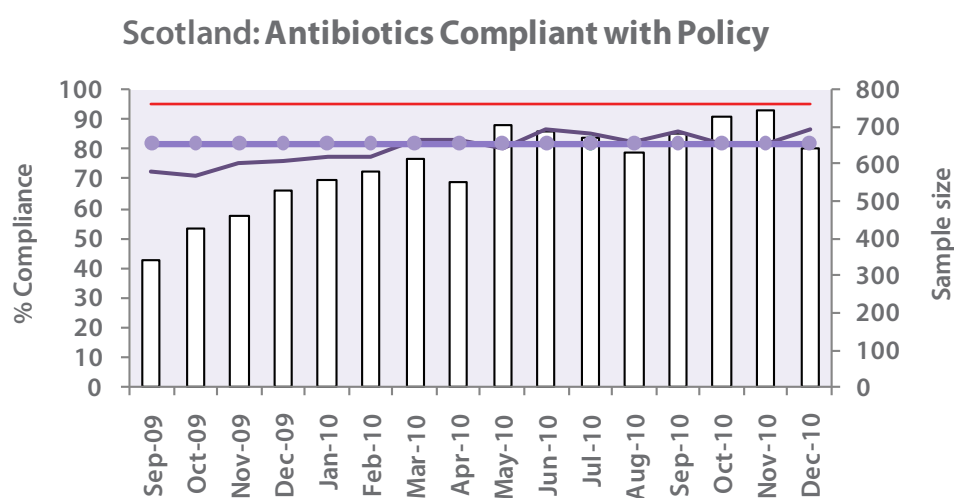


Figure 6: National data for antibiotics compliant with local policy in acute admission units

Scotland: Indication Documented in Notes

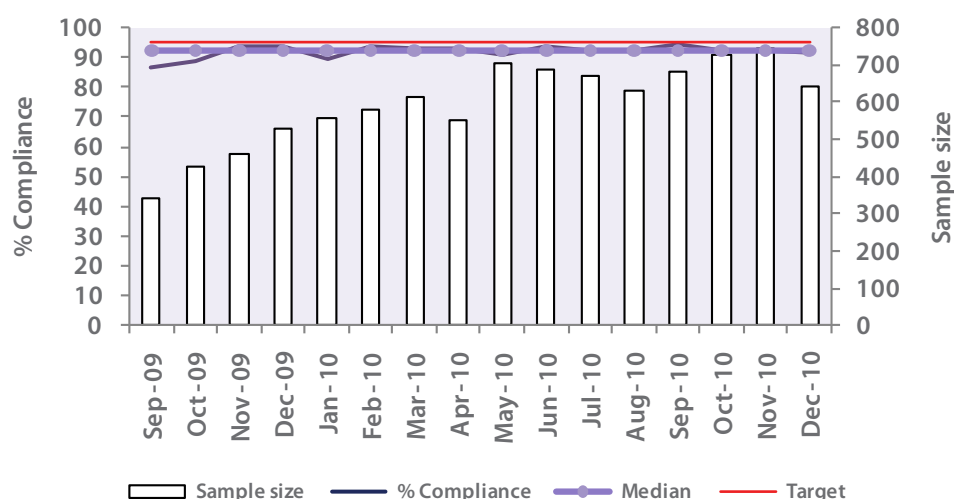


Figure 7: National data for indication documented in medical notes in acute admission units

For the surgical prophylaxis indicator local data from a variety of hospitals, collecting different procedures, show a variable level of compliance with local policy but these data are not suitable for comparison between NHS boards or national reporting. While compliance with policy can be easily collected there appears to be no simple, reliable and sustainable means of collecting data in relation to duration of prophylaxis. Both measures are now being incorporated into the Scottish Patient Safety Programme (SPSP) surgical checklist and a robust mechanism of collecting and reporting data to support quality improvement is presently being developed.

Next steps

- For surgical prophylaxis we will continue to work with SPSP to integrate data collection and reporting. We are also working with the HPS Surgical Site Infection (SSI) programme¹⁸ to allow AMTs to utilise their data at local level to identify areas for quality improvement as well as collaborating on development of the HPS SSI dataset to include measures relating to surgical prophylaxis for all surgical procedures. SAPG has also started discussions with the Scottish Audit of Surgical Mortality¹⁹ leads to facilitate addition of measures of surgical prophylaxis to their dataset as a means of increasing engagement of surgical colleagues in the quality improvement agenda.
- We plan to review all three CDI HEAT target prescribing indicators to assess their ongoing utility in parallel with the Scottish Government process for review of the current HEAT targets.

Primary care

Local primary care antibiotic policies were reviewed by the Primary Care Practice Sub-group. A survey of current policies showed that most NHS board policies were broadly similar and were based on the Health Protection Agency (HPA) template¹⁵. The benefits of using this template are that the supporting evidence is reviewed and updated every 6 months. National consensus was reached on formally adopting this template as the basis for a Scottish primary care policy. The HPA have welcomed this and SAPG members have contributed to their review process.

SAPG has worked with colleagues in the Scottish Government Primary Care Division to promote quality prescribing initiatives to GPs via the Medicines Management elements of the Quality Outcomes Framework²⁰ (QOF). To date, significant improvements in both the quantity and quality of antibiotic prescribing in primary care have been seen (as detailed in the Information Work Stream section).

A key area of work has been to reduce patient expectation for antibiotics in self-limiting viral infections by educating patients and the public about prudent use of antibiotics. A sub-group of healthcare professionals and patient representatives was established to develop a national approach to provision of patient information and a poster (Figure 8) and leaflets were developed and used in 2010 for a national public health campaign to coincide with European Antibiotic Awareness Day²¹. Campaign materials were distributed to GP Practices and Community Pharmacies throughout Scotland and the key messages were also shared with colleagues in the Care Commission and the Long Term Conditions Alliance to reach as many potential patients as possible. A Scottish Government media release about prudent use of antibiotics also helped to get local and national media to report the message.

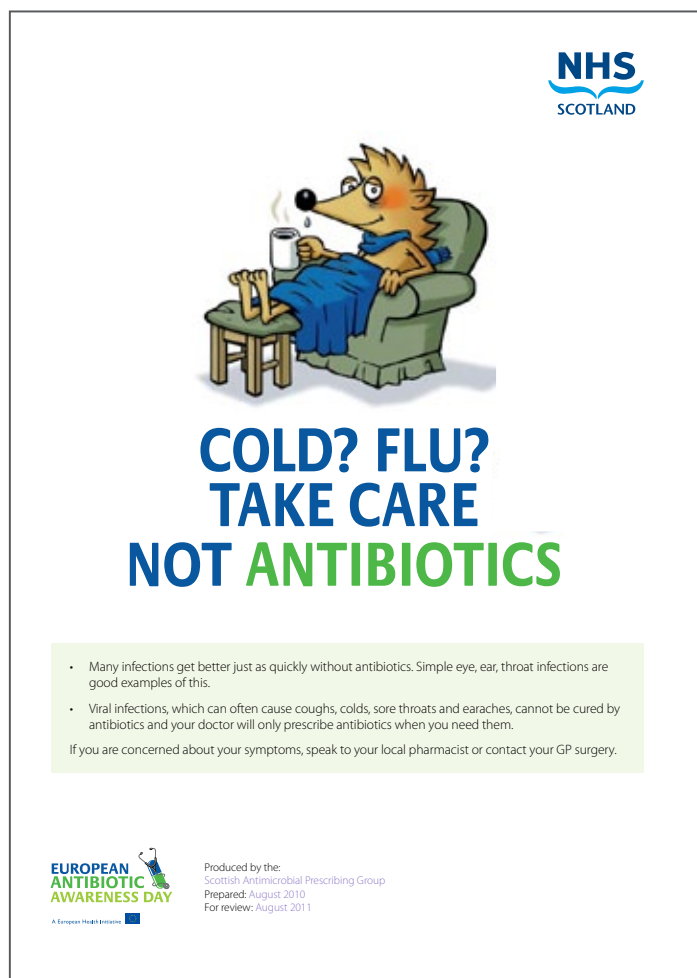


Figure 8: SAPG poster for European Antibiotic Awareness Day 2010

Work has begun to improve the use of antibiotics within long term care facilities and Care Homes as this patient population is particularly vulnerable to HAI, particularly CDI. Effective implementation of local primary care antibiotic policies and provision of education on antibiotic use for healthcare staff are key to improving quality of care and patient safety. A pilot project is under way to assess the impact of an education initiative delivered by pharmacists on antibiotic use in a sample of Care Homes throughout Scotland. This work has been developed in collaboration with the Care Commission²², NHS boards and care provider organisations.

Next steps

- Through ongoing collaboration with Scottish Government Primary Care colleagues, we will develop measures of prescribing practice to reduce the total quantity of antibiotics prescribed.
- The results of the Care Homes pilot project will inform a national approach to education on antibiotic use for Care Home and community hospital staff and will be aligned with education to address the wider HAI agenda currently being developed by NES and the Care Commission.
- In 2011 the Infection Management work stream will become the Quality Improvement work stream as the SAPG work plan develops more quality improvement initiatives and becomes aligned with other national programmes.

Andrew Seaton, Work stream Lead/ Consultant in Infectious Diseases, NHS Greater Glasgow & Clyde

Jacqueline Sneddon, SAPG Project Lead, Scottish Medicines Consortium

On behalf of SAPG clinicians

Community Acquired Pneumonia Work Stream

This work, led by the SNAP-CAP Steering Group, involves improving the management of community acquired pneumonia (CAP) which is a common and potentially serious respiratory infection.

The Scottish National Audit Project – Community Acquired Pneumonia¹⁷ (SNAP-CAP) originated in 2006 as a quality improvement initiative hosted by the Royal College of Physicians Edinburgh and funded by the Health Foundation²³. This funding ended in June 2009 and SAPG agreed to take over the project with funding secured from the Scottish Government HAI Task Force.

Patients with severe CAP require urgent hospital admission and treatment with intravenous antibiotics, while patients with mild CAP can be treated at home with oral antibiotics. SNAP-CAP involved development and implementation of an evidence-based care bundle to optimise the management of patients presenting to hospital with CAP. In 2010 we have completed a literature review to update the evidence for the care bundle elements and are planning to revise the bundle to target patients with severe CAP.

The project involves collection of data by clinical teams in Acute Medical Admissions Units from patients presenting with CAP and uses quality improvement methodology to address non-compliance with bundle elements. Data management is via the SAPG Extranet described in the CDI HEAT target section (3.4.2). Another feature of this improvement approach is that clinical teams participate in a monthly teleconference to discuss their results and share good practice. Currently six teams are taking part in a 'breakthrough collaborative' which aims to achieve sustained and reliable compliance with all bundle elements. In the first 90 days they have focused on oxygen assessment and administration, with all achieving target, and on CURB65 recording, which has been less successful (Figure 9). In the next stage, teams will focus on prompt administration of IV antibiotics to patients with severe CAP.

SNAP-CAP Breakthrough Collaborative 90-day Project Phase 1 Results

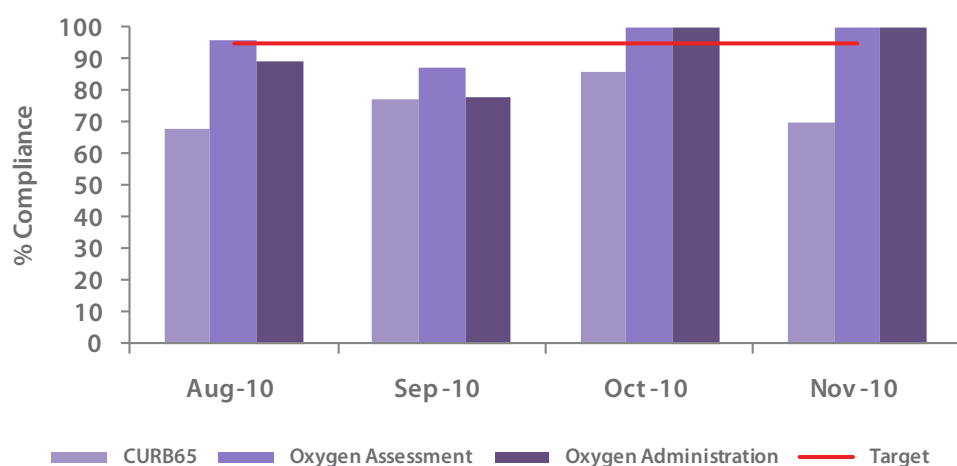


Figure 9: Compliance with measures from first SNAP-CAP 90-day project (phase 1)

Next steps

- A key outcome measure for SNAP-CAP is evaluating whether implementing the care bundle results in reduced mortality due to CAP. Initial data analysis suggests that data available from ISD can be used to monitor death within 30 days of admission in patients with a diagnosis of CAP and this can be combined with bundle compliance to conduct an outcome analysis. Development of this methodology is ongoing.
- In 2011 SNAP-CAP will become part of the Quality Improvement Work Stream.

Peter Davey, Lead Clinician for Clinical Quality Improvement, NHS Tayside

Andrea Patton, Information Analyst, SAPG

On behalf of the SNAP-CAP Steering Group

Additional work

In 2010 SAPG was asked to contribute to a Scottish Government short-life working group set up to develop and implement quality standards for management of neutropenic sepsis. SAPG's contribution has been to draft best practice statements for initial hospital management of patients presenting with neutropenic sepsis and in 2011 we will develop the SAPG Extranet system to provide data management for audit against the new standards.

Conclusion

SAPG is now established and has successfully engaged with national stakeholders and AMTs throughout Scotland and has developed a national consensus approach to the use of antimicrobials. The completion of data management systems for prescribing, surveillance and clinical audit has provided essential information to support and direct future work.

SAPG Work plan 2011-14

In the coming year our priorities will be aligned with the three key elements of the Healthcare Quality Strategy²⁴ – delivery of safe, effective, person-centred, care to all patients with infections. We will consolidate current interventions, further develop quality improvement initiatives in collaboration with other national stakeholders, embed education on antimicrobial prescribing in undergraduate teaching and postgraduate continuing professional development for all healthcare professionals and evaluate the outcomes of our interventions.

As we move into the next 3-year HAI Task Force Delivery Plan, SAPG will become fully integrated within the HAI Task Force ensuring that antimicrobial stewardship is established as a critical element for tackling both HAI and the emergence of resistant organisms.

The following actions will support NHS boards and frontline clinical staff to enhance the quality of antimicrobial prescribing across all healthcare settings.

- Integration of core SAPG work with key local, national and international stakeholders working in HAI and quality improvement at both strategic and operational levels.
- Maintain delivery of existing stewardship activities and evaluation of their impact at a local and national level.
- Development of antimicrobial stewardship activities in primary care integrated with other national programmes.
- Application of quality improvement methodology to clinical priority areas to optimise patient care in management of infections.
- Development and promotion of evidence base for antimicrobial stewardship interventions and antimicrobial resistance.

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17. Scottish National Audit Project – Community Acquired Pneumonia www.scottishmedicines.org.uk/SAPG/SNAP-CAP/Community_Acquired_Pneumonia__SNAP-CAP__Quality_Improvement_Project_-_Workstream
18. Health Protection Scotland Surgical Site Infection programme www.hps.scot.nhs.uk/haic/sshaip/surgicalsiteinfectionsurveillance.aspx
19. The Scottish Audit of Surgical Mortality www.sasm.org.uk/
20. NHS Quality and Outcomes Framework www.qof.ic.nhs.uk/
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24. Healthcare Quality Strategy, Scottish Government, 2009 www.scotland.gov.uk/Publications/2009/10/16100145/0

APPENDIX 1 – SAPG Membership

SAPG representation	Name	Job title/Specialty
Chair	Professor Dilip Nathwani	Consultant in Infectious Diseases NHS Tayside
Professional Project Lead	Dr Jacqueline Sneddon	Principle Pharmacist Scottish Medicines Consortium
Project Officer	Ms Susan Paton	Project Officer Scottish Medicines Consortium
Representative from Medical Directors Group and Vice Chair	Dr Bob Masterton	Medical Director & Consultant Microbiologist NHS Ayrshire & Arran
Representative from Directors of Pharmacy Group and Vice Chair	Mrs Gail Caldwell	Director of Pharmacy NHS Forth Valley
Representatives from Scottish Medicines Consortium Executive Team	Mrs Angela Timoney	Vice Chair SMC and Director of Pharmacy NHS Tayside
	Mrs Laura McIver/Mrs Anne Lee	Chief Pharmaceutical Adviser/Acting Chief Pharmaceutical Adviser Scottish Medicines Consortium
Lead for Information Work Stream (Pre-scribing)	Professor Marion Bennie	Chief Pharmaceutical Adviser NHS National Services Scotland
Lead for Information Work Stream (Surveillance)	Dr Anne Eastaway	Consultant Microbiologist Health Protection Scotland
Pharmaceutical adviser for Information Work Stream	Mr William Malcolm	Pharmaceutical Adviser, Health Protection Scotland
Lead for Antimicrobial Resistance Programme	Dr Camilla Wiuff	Epidemiologist and Programme Manager Health Protection Scotland
Lead for Education Work Stream	Mrs Liz Gillies/Ms Helen Maitland	Education Lead for ScotMARAP/HAI Programme Director, NHS Education for Scotland
Pharmacy Representative on Education Work Stream	Mrs Arlene Brailey	Assistant Director of Pharmacy NHS Education for Scotland
Lead for Organisation Work Stream	Dr Peter Christie/Mrs Jackie Ley	Consultant in Public Health Medicine/Nurse Consultant - HAI Team NHS Quality Improvement Scotland
Lead for Infection Management Work Stream	Dr Andrew Seaton	Infectious Diseases Consultant NHS Greater Glasgow and Clyde
Lead for SNAP-CAP Work Stream and representative for International Liaison	Professor Peter Davey	Lead Clinician for Clinical Quality Improvement NHS Tayside
SNAP-CAP Project Co-ordinator and SAPG Information Analyst	Ms Andrea Patton	Advanced Information Analyst Scottish Medicines Consortium
Representative from Scottish Government Healthcare Associated Infection Team	Mrs Lorna Willocks/Mrs Carol Fraser/Mr Kevin Hanlon	Senior Medical Advisor HAI/Nurse Adviser HAI/Head of HAI Policy Unit Scottish Government Health Directorates
Representative from the Scottish Patient Safety Programme	Dr Malcolm Daniel /Dr Emma Watson	Consultant in Anaesthesia & Intensive Care NHS Greater Glasgow and Clyde Consultant Microbiologist NHS Highland
Professional Secretary for ScotMARAP	Ms Ysobel Gourlay	Lead Antimicrobial Pharmacist NHS Greater Glasgow and Clyde
Representative from Association of Scottish Antimicrobial Pharmacists	Dr Nicholas Reid	Lead Antimicrobial Pharmacist NHS Ayrshire & Arran
Antimicrobial Management Team Representatives	Dr Martin Connor	Consultant Microbiologist and Infection Control Doctor NHS Dumfries & Galloway
	Mrs Alison Cockburn/Ms Carol Philip/Dr Karen MacSween	Antimicrobial Pharmacist/Consultant Microbiologist NHS Lothian

SAPG representation	Name	Job title/Specialty
Representative from Scottish Microbiology Forum	Dr Ian Gould	Consultant Microbiologist NHS Grampian
Representative from Infectious Diseases Consultants Group	Dr Nick Kennedy/Dr Stephanie Dundas	Consultant in Infectious Diseases NHS Lanarkshire
Representative from Chief Executives Group	Mr Mike Grieve	Director of Delivery NHS Lothian
Representative from Infection Control Managers Group	Dr Robert Gray/Mr Robert Wilson	Infection Control Manager Golden Jubilee National Hospital Infection Control Manager NHS Ayrshire & Arran
Public Health representative	Mr Ishtiaq Mohammed	Clinical Effectiveness Pharmacist NHS Fife
General Practitioner	Dr Simon Hurding/Dr Gail Haddock	General Practitioners NHS Highland
Dental representative	Dr Alexander Crichton	Consultant in Oral Medicine Glasgow School of Dentistry
Veterinary representative	Mr Jesus Gallego	Veterinary Adviser (Meat Hygiene) Scottish Government Health Directorates
Representative for Undergraduate Medical Education	Professor Hamish McKenzie	Head of Division of Medical and Dental Education University of Aberdeen
Representative from Infection Prevention Society	Ms Sybil Solomon	Nurse Consultant in Infection Control NHS Forth Valley
Representative from Scottish Infection Research Network	Dr Alistair Leonard	Director of Scottish Infection Research Network University of Glasgow
Patient representative	Mrs Sheila Tunstall-James	Public Partner SMC Patient and Public Involvement
Association of the British Pharmaceutical Industry representative	Dr John Northfield/Dr John Porter	Medical Advisor (Anti-Infectives) Astellas UK Ltd Pfizer UK Ltd
Representative from Care Commission	Mr David Marshall	Pharmacy Adviser Care Commission

APPENDIX 2 – National Network Events

18th November 2008, Stirling Highland Hotel

This inaugural event to mark the first European Antibiotic Awareness Day was an introduction to SAPG. The event concentrated on the role of SAPG, communication of current measures being used to tackle *C. difficile* and introduced the Scottish National Audit Project – Community Acquired Pneumonia (SNAP-CAP). The event was attended by 48 delegates and feedback from the event included suggestions for future events which are now used.

3rd March 2009, Royal Pharmaceutical Society of Great Britain, Edinburgh

This event communicated details of the Information work stream of SAPG using presentations, discussions and workshops on the use of national and local antimicrobial prescribing and surveillance data. Guest speakers from the Welsh Antimicrobial Resistance Programme: Surveillance Unit presented details of their programme. The event was attended by 50 delegates.

2nd June 2009, Royal College of Physicians of Edinburgh

This event concentrated on the Infection Management work stream. Topics included discussion on 2009 update of the British Thoracic Society Guidelines, local surveillance data, local plans for data collection for hospital CDAD HEAT targets, development of national policies for surgical prophylaxis and use of gentamicin and vancomycin. The event was attended by 55 delegates.

29th September 2009, Royal College of Physicians of Edinburgh

This event concentrated on primary care and the Education work stream. Topics included the adoption of a national antimicrobial policy in primary care, prescribing indicators developed in PRISMS and methods to influence prescribers on use of antimicrobial prescribing data. Progress with the education work stream was highlighted and online learning packages and materials were demonstrated. The event was attended by 50 delegates.

9th February 2010, Stirling Management Centre, Stirling

This event was held to showcase SAPG's first annual report and was opened by Ms Nicola Sturgeon, Minister for Health and Wellbeing. Key successes were highlighted and NHS board managers and AMTs discussed how SAPG has influenced antimicrobial stewardship at local level. The event was attended by 100 delegates bringing together a wide range of managers and clinicians.

8th June 2010, Our Dynamic Earth, Edinburgh

This event was held jointly with Scottish members of the Society for Acute Medicine to discuss current challenges in managing infection within Acute Medicine and opportunities for quality improvement. Workshop sessions focused on how Acute Medicine and SAPG can collaborate to ensure every patient gets the right antibiotic first time. The event was attended by 100 delegates with about half of these medical, pharmacy and nursing staff from Acute Medicine

24th November 2010, NHS QIS Elliott House, Edinburgh

This event aimed to update AMTs on the HAI Taskforce and SAPG's future plans as well as present some examples of local good practice in influencing primary care prescribing. Workshop sessions discussed progress with local data requirements of the national surveillance framework. The event was attended by 60 delegates.

APPENDIX 3 – Presentations and Publications

Presentations:

The Scottish Antimicrobial Prescribing Group I. Gould
Australian Health Commission, Sydney, Australia, September 2008

Antimicrobial Stewardship: The Scottish National Approach. D. Nathwani
2nd Annual Scientific Meeting of the Infectious Diseases Society of Ireland (IDSI). Dublin, Ireland, 11th June 2009

The Scottish Antimicrobial Prescribing Group I. Gould
Ontario Hospitals Association, Ontario, Canada, June 2009

Antimicrobial Stewardship in Scotland J. Sneddon
Welsh Antimicrobial Resistance Meeting, Cardiff, April 2010
And Infection Management Showcase Showdown, Lewisham Hospital, London, July 2010

Antimicrobial Stewardship – Triumphs and Consequences J. Sneddon
Presentation at Federation of Infection Societies conference, Edinburgh, November 2010

Posters:

National Collaboration on Antimicrobial Stewardship: Scottish Antimicrobial Prescribing Group European Antibiotic Awareness Day 18th November 2008, Science Museum, London (P. Christie, C. Wiuff) and NHS Scotland Event, 16th-17th June 2009, Scottish Exhibition & Conference Centre (J.Sneddon)

Which clinical improvement model do I use? A. Patton
International Society for Quality in Healthcare (ISQua) meeting 13th October 2009, Dublin, Republic of Ireland

A National Approach to Antimicrobial Stewardship in Primary Care S. Hurding
Royal College of General Practitioners Conference, 5th-7th November 2009, Royal College of Physicians Edinburgh

The Development of National Prescribing Indicators for Antimicrobials and A National Approach to Antimicrobial Stewardship in Primary Care J. Sneddon
Infection 2009 Conference, 11th-13th November 2009, Birmingham International Conference Centre

The Scottish Antimicrobial Prescribing Group J. Sneddon
Celtic Pharmacy Festival, Edinburgh, March 2010

The Development of National Prescribing Indicators for Antimicrobials J. Sneddon
What improvement in reliability of care is required to make a difference to clinical outcome? A. Patton
International Forum on Quality and Safety in Healthcare, 20th– 23rd April 2010, Nice, France:

Journal publications:

Plotting the path of least resistance
Nathwani D, Sneddon J. Public Servant Scotland, March 2010 18-19

Overview of strategies for overcoming the challenge of antimicrobial resistance
Davey P, Nathwani D, Sneddon J Expert Rev. Clin. Pharmacol. 3(5), 667–686 (2010)

Scottish Antimicrobial Prescribing Group [SAPG]: Development and impact of the Scottish National Antimicrobial Stewardship Programme. Nathwani D et al
In press, International Journal of Antimicrobial Agents and Chemotherapy, 2011

APPENDIX 4 – Glossary of Abbreviations

ADTC	Area Drug and Therapeutics Committee
AMT	Antimicrobial Management Team
CDAD	<i>Clostridium difficile</i> associated disease
CDI	<i>Clostridium difficile</i> infection
DDD	Defined daily dose
EARSS	European Antimicrobial Resistance Surveillance System
ESAC	European Surveillance of Antimicrobial Consumption
HAI	Healthcare Associated Infection
HEAT	Health improvement, Efficiency, Access and Treatment
HEI	Healthcare Environment Inspectorate
HMUD	Hospital Medicines Utilisation Database
HPA	Health Protection Agency
HPS	Health Protection Scotland
ISD	Information Services Division
NES	NHS Education for Scotland
NSS	NHS National Services Scotland
PRISMS	Prescribing Information System for Scotland
NHS QIS	NHS Quality Improvement Scotland
RCPE	Royal College of Physicians of Edinburgh
RCGP	Royal College of General Practitioners
SAPG	Scottish Antimicrobial Prescribing Group
ScotMARAP	Scottish Management of Antimicrobial Resistance Action Plan
SMC	Scottish Medicines Consortium
SNAP-CAP	Scottish National Audit Project – Community Acquired Pneumonia
SPSP	Scottish Patient Safety Programme
SSI	Surgical site infection

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