Effects of antimicrobial stewardship and infection control measures on MRSA infections

A retrospective observational study in Scotland found that an antimicrobial stewardship intervention combined with infection prevention and control measures reduced meticillin-resistant *Staphylococcus aureus* (MRSA) infections in hospital and community settings.

**Overview:**
- The introduction of antimicrobial stewardship measures in a region of Scotland resulted in significantly lower than predicted meticillin-resistant *Staphylococcus aureus* (MRSA) prevalence in hospitals and in the community.
- Combining antimicrobial stewardship with infection prevention and control methods significantly reduced MRSA prevalence by around half in both hospital and community settings.
- The findings highlight the value of persuasive and restrictive interventions to reduce MRSA prevalence and support the NICE recommendation to establish antimicrobial stewardship programmes.

**Background:** MRSA is a leading cause of antibiotic-resistant infections worldwide (Stefani et al. 2012).

The Department of Health’s [UK five year antimicrobial resistance strategy 2013 to 2018](https://www.gov.uk/government/publications/uk-five-year-antimicrobial-resistance-strategy-2013-to-2018) aims to slow the development and spread of antimicrobial resistance. The report describes 3 strategic aims: improve the knowledge and understanding of antimicrobial resistance; conserve and steward the effectiveness of existing treatments; and stimulate the development of new antibiotics, diagnostics and novel therapies.

‘Antimicrobial stewardship’ is a term used to describe an organisational or healthcare-system-wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness.
**Current advice:** The NICE guideline on [antimicrobial stewardship](#) covers the effective use of antimicrobials (including antibiotics) in children, young people and adults. It aims to change prescribing practice to help slow the emergence of antimicrobial resistance and ensure that antimicrobials remain an effective treatment for infection.

The guideline includes recommendations for both organisations and individual prescribers on: antimicrobial stewardship programmes and teams; antimicrobial stewardship interventions; communication with and among health and social care practitioners; laboratory testing; antimicrobial prescribing; and dealing with new antimicrobials. It also highlights interventions for changing prescribing practice.

The NICE pathway on [antimicrobial stewardship](#) brings together all related NICE guidance and associated products on this issue in a set of interactive topic-based diagrams.

**New evidence:** A retrospective, observational, quasi-experimental study in Scotland by [Lawes et al. (2015)](#) considered the effects of antimicrobial stewardship, and infection prevention and control measures, on MRSA rates.

Efforts to reduce hospital use of macrolide antibiotics had been ongoing in the NHS Grampian region since January 2008. In May 2009, an antimicrobial stewardship intervention was introduced in both hospital and community settings. This intervention contained persuasive elements and restrictive elements. The persuasive elements were:

- promotion of antibiotic guidelines to avoid ‘4C’ antibiotics (fluoroquinolones [including ciprofloxacin], clindamycin, cephalosporins and co-amoxiclav)
- reminders for clinical staff
- feedback
- ward-based audits.

The restrictive elements were:

- removal of 4C antibiotics from hospital clinical areas
- requiring authorisation by a medical microbiologist or infectious disease specialist for any use of 4C antibiotics, unless for empirical treatment for agreed indications
- disclosing sensitivities to 4C antibiotics in microbiology reports only if there were no alternative options.

Infection prevention and control interventions were also introduced in Scotland at various time points during the study period. These included a hand hygiene campaign, monthly auditing of hospital cleaning, unannounced inspections, MRSA admission-screening policies, and isolation and treatment of people who had MRSA.

Data on 16 years’ worth of antibiotic use and MRSA rates were taken from the NHS Grampian health board for January 1997 to December 2012. These data were collected when antimicrobial stewardship, and infection prevention and control measures, had been implemented. These were then compared with predicted data from ‘no intervention’ scenarios estimated from time-series models. The primary outcome was the prevalence density of hospital or community MRSA.

The population comprised 1,289,929 adults who were admitted to hospital and 455,008 people aged 16 years or over registered in primary care. There were 10,307 MRSA infections in hospitals and 7647 in the community.

Compared with forecasted use without stewardship, use of 4C and macrolide antibiotics during antimicrobial stewardship fell by nearly a half (47%) in hospitals (mean decrease=224 defined daily doses [DDDs] per 1000 occupied bed days [OBDs], 95% confidence interval [CI] 154 to 305, p=0.008) and just over a quarter (27%) in the community (mean decrease=2.52 DDDs per 1000 inhabitants per day [IDs], 95% CI 0.65 to 4.55, p=0.031).
Compared with estimated ‘no intervention’ scenarios, antimicrobial stewardship significantly reduced MRSA prevalence by 54% in hospitals (mean reduction=0.60 per 1000 OBDs, 95% CI 0.01 to 1.18, p=0.049) and 37% in the community (mean reduction=0.017 per 10,000 IDs, 95% CI 0.004 to 0.029, p=0.012). Antimicrobial stewardship combined with infection prevention and control methods significantly reduced MRSA prevalence by 50% in hospitals (absolute difference=0.94 cases per 1000 OBDs, 95% CI 0.27 to 1.62, p=0.006) and 47% in the community (absolute difference=0.033 cases per 10,000 IDs, 95% CI 0.018 to 0.048, p<0.0001).

The authors concluded that alongside infection prevention and control measures, implementation of a national antibiotic stewardship intervention meant that the rates of hospital-associated and community-associated MRSA were significantly lower than if these interventions had not been in place. The observational nature of this study meant that no conclusions could be drawn about whether different factors caused reductions in MRSA prevalence.

Commentary by Dr Tessa Lewis, GP, Aneurin Bevan University Health Board:

“This extensive analysis addresses antimicrobial resistance as a primary outcome and is therefore a welcome addition to the limited evidence base on effective interventions to reduce antimicrobial resistance. The study populations were UK-based, with good generalisability: primary care registrations and adult admissions to a tertiary hospital, a district general hospital and a geriatric hospital. Children were not included.

“The antimicrobial stewardship intervention was led by the regional antibiotic management team, which comprised primary care and antibiotic pharmacists and microbiology and infectious disease specialists. A team approach working across all care settings is a key theme of the NICE guideline on antimicrobial stewardship.

“The persuasive and restrictive interventions used are consistent with well-recognised approaches to antimicrobial stewardship and support the detailed recommendations within the NICE guideline. The choice of restricted 4C antibiotics is representative of current interventions across UK, but this study also included macrolide restriction.

“The study analysed the difference between observed (with intervention) and predicted (without intervention) MRSA rates. A key limitation, as the authors state, is that ‘The observational design of this study limits conclusions about causality in temporal associations’. In addition, the study explored ecological determinants of MRSA infection and did not include patient outcomes.

“During the study period, total antibiotic use (defined daily doses) increased by 45% in hospitals and 33% in the community; this was unaffected by antimicrobial stewardship. However, there were sustained reductions in 4C antibiotics used.

“The authors suggested that reducing use of restricted antibiotics to below a specific threshold would be effective in reducing MRSA. The threshold is population specific; for example, any threshold would be lower in the geriatric population.

“This observational study adds to the evidence that antibiotic stewardship and infection control measures have positive and complementary roles in the control of MRSA.”

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