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# A web-based pharmacy to microbiology referral system

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With issues such as resistance and cost-effectiveness, antibiotic prescribing is an area where pharmacists can provide valuable input. This article describes the implementation of a web-based pharmacy referral system at St Mary's NHS Trust

The image shows three screenshots of a web-based interface for a pharmacy referral system. The first screenshot (top left) is titled 'Step 1. Enter patient, pharmacist and contact details' and contains several text input fields for patient name, address, and contact information. The second screenshot (bottom left) is titled 'Step 2. Current treatment' and features a table for entering antimicrobials with columns for name, dose, and frequency. The third screenshot (right) is titled 'Step 3. Enter clinical details, include as much information as possible' and includes a large text area for clinical notes, a section for 'Enter the most recent tests for the following, if available' with dropdown menus for WCC, CRP, and Creatinine, and a section for 'Enter notes - include all relevant details'.

The ward level SMART interface

Pharmacists are increasingly recognised as being an integral part of the multidisciplinary microbiology and infectious diseases team.<sup>1,2</sup> In June 2003, the Department of Health announced specific funding for hospital pharmacists to expand their roles within anti-infective management.<sup>3</sup> Many specialist posts have now been created, each with a remit reflecting the needs of their hospital trust,<sup>1,4-6</sup> but with core activities typically including the following:

- Writing evidence-based prescribing guidelines for antimicrobials
- Monitoring antibiotic use and expenditure
- Antibiotic teaching and training for pharmacy and medical staff
- Attending ward rounds and acting as a point of contact between pharmacy and microbiology, infectious diseases and infection control teams

At St Mary's Hospital in London, the senior microbiology pharmacist's role encompasses all of the above, and has been in existence for over seven years. Although originally funded as a cost-saving initiative, this post is now funded on a quality basis, and the team has been expanded by the addition of a junior pharmacist support post.

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The increase in staffing allows a more personalised approach to problem-solving within the antimicrobial field. This may help to address the recognised failure of traditional means of communication to encourage the appropriate use, and discourage the abuse of anti-infectives.<sup>5,7-9</sup> Such personal contact may result in the more prudent use of these agents, where passive educational methods such as posters and general education sessions have failed.<sup>10</sup>

A model that we have developed at St Mary's enables anti-infective issues from across the hospital trust to be addressed promptly by specialist pharmacy and microbiology staff. Ward pharmacists refer all complex antibiotic-related queries to the specialist microbiology pharmacists, who resolve these either directly, or following discussion with the microbiology and infectious diseases doctors. Ongoing issues are raised at twice-weekly multidisciplinary meetings, and a weekly pharmacy-led microbiology ward round has been established for over three years.<sup>5</sup> All plans and recommendations are communicated personally to the ward pharmacist, and the clinical teams are informed personally or via the medical notes.

The increasing volume of referrals for this round prompted us to remodel the referral system, moving from a paper-based system to a web-based database, available on the wards — St Mary's Antimicrobial Referral Tool (SMART). The ward-level interface improves accuracy and completeness of referrals, streamlining the referral process, facilitating audit and improving manageability of information.

## Database construction

A Microsoft Access database was constructed to record data and the robustness and validity of the design was tested during a pilot period using real referrals. The ward-level interface operates via a web browser, and is accessed via a hyper-link in the trust electronic formulary, which is available on terminals throughout the hospital as part of the trust intranet.

Completion of the referral form on the ward takes two to three minutes, with immediate submission to the database. The form prompts the ward pharmacist to collate the background clinical information required for a preliminary review, and classify their query. Errors and omissions in the referral details are minimised because the form can be completed on the ward with the patient notes to hand. The database is checked at least once a day, and referrals are prioritised by the microbiology pharmacists for either immediate action or review on the ward round.

The administration files are only available to the microbiology pharmacists and microbiologists. With a direct link to the trust pathology reporting system, the microbiology pharmacists can document microbiology sensitivities, blood results and other relevant information. A record is kept of each intervention, including feedback to pharmacists and clinicians. The form also provides space to record cost savings associated with each intervention.

A report can be created collating all the information onto one A4 page per patient.

This is useful for the twice-weekly microbiology meetings, where enquiries are presented by the microbiology pharmacist to the microbiology and infectious diseases clinicians and treatment options are discussed. Referral answers are communicated either directly to the clinical team looking after the patient and the ward pharmacist or just to the ward pharmacist. If the patient is visited by the pharmacy microbiology team, an entry will be made in the patient notes. In each case the ward pharmacist ensures that the intervention is actioned and is provided with a learning opportunity with each enquiry. The database can be searched to generate summary data of enquiries by drug, query type, action taken etc, and cost savings achieved. The system is undergoing continual revision, and work is currently under way on automated activity reporting.

### — The first nine months

Since the introduction of the prototype SMART system in January 2005, 222 referrals have been received, an average of six per week. This does not represent the entire volume of queries handled by the microbiology pharmacists, since simple queries (such as dose reductions in renal impairment) are typically answered without recording them on the system. Approximately 25 to 30 non-recorded queries are answered per week. However, SMART referrals tend to take longer to answer due to their more complex nature, and dealing with the referrals and feedback takes approximately two and a half to three hours per week. This estimate excludes more complex queries requiring a literature search.

Queries most commonly involved the choice of antibiotic (64 per cent of classified referrals) and the course length (20 per cent of classified referrals). The remainder concerned microbiology approval of restricted antibiotics, renal or hepatic dose reduction, therapeutic drug monitoring, and adverse drug reactions (6 per cent), or other queries outside the standard classifications (10 per cent). The low frequency of referrals concerning approval, dosage, monitoring and adverse effects probably reflects the fact that these relatively simple queries were often answered by the microbiology pharmacists

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### SMART software availability

Following a presentation given by Hayley Wickens at the Specialist Advisory Committee on Antimicrobial Resistance conference for microbiology specialist pharmacists, several requests to share this software have been received.

Although the software has been specifically written to solve a problem at St Mary's NHS Trust, it is expected that SMART will be made available to other users. A version that could be modified for local use is under development. Further details can be obtained by e-mailing Hayley Wickens at [hayley.wickens@stmarys.nhs.uk](mailto:hayley.wickens@stmarys.nhs.uk)

without recourse to the SMART system.

Where recommendations from the microbiology team are not followed, the patient remains active on the system until there is a satisfactory resolution of the situation. Currently, approximately five patients are active on the system at any given time. Documenting individual patient outcome is not always feasible due to the labour-intensive nature of following up each patient through to discharge. However, as the NHS IT development agenda progresses, documenting length of stay and readmissions for individual patients may become more feasible. This will facilitate research work concerning the clinical effects associated with antibiotic team intervention; currently there are few data from the UK to demonstrate any benefits, although some US hospitals have shown an improvement in clinical outcomes through such activities.<sup>11</sup>

### — Progress

SMART allows pharmacists to make detailed antibiotic referrals at ward level, replacing the informal paper system that was previously used. There is now a systematic, searchable record of referrals, and a large database of problems and resulting interventions is forming. In addition, the trust microbiologists have requested direct access to the system because they believe it will be useful for keeping track of clinical advice given.

Uptake of the new system by pharmacists was hesitant initially, but is gathering momentum following launch meetings and a poster campaign. An increased schedule of accompanied ward visits by the senior microbiology pharmacist will enable further individual training and reinforce the availability of the system. The system itself is under a continual process of development and optimisation, with the aim of improving user-friendliness and speed of use.

A project is under way to assess pharmacist acceptability of the system, and to investigate the feasibility of extending access to medical staff, thus enabling referrals to be made directly by the clinical teams. A mobile version, which would allow the microbiology pharmacists to access referrals on the wards using personal data assistants, is another potential development. Ideally, this would run on a wireless network, but this is not currently in place.

### — Conclusion

SMART aims to facilitate communication between microbiology and infectious diseases teams, enable pharmacists and clinicians to document the ways in which pharmacists contribute to prudent prescribing of antimicrobials, and ultimately improve patient care. Further developments of the system are expected to increase ease of use both for referring pharmacist and microbiology specialist, and optimise reporting output.

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## Correction

The e-mail address for Hayley Wickens, for obtaining further details about SMART software is  
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