Antimicrobial stewardship; are we failing in cross-specialty engagement?

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Running Title: Cross Specialty Coverage of Antimicrobial Stewardship

Search terms:
Antimicrobial resistance, clinical leadership, specialty conferences
Abstract

Background
Antimicrobial resistance (AMR) is a public health priority and a leading patient safety issue. Globally, antimicrobial stewardship (AMS) has been integral in promoting therapeutic optimisation whilst minimising harmful antimicrobial use. A cross sectional, observational study was undertaken to investigate the coverage of AMS and antibacterial resistance across medical scientific conferences in 2014, as a surrogate marker for current awareness and attributed importance.

Method
Medical specialties were identified, and the largest corresponding medical scientific/research conferences in 2014 determined (a) within the UK and (b) internationally. Conference characteristics and abstracts were interrogated and analysed to determine those which were related to AMS and AMR. Inter-specialty variation was assessed using chi-squared or Fisher’s exact statistical analysis.

Results
In total, 45 conferences from 23 specialties were analysed representing a total of 59,682 accepted abstracts. The UK had a significantly greater proportion of AMS/AMR related abstracts compared to international conferences (2.8%; n=221/7843 cf. 1.8%; n=942/51839; p<0.001). Infection conferences contained the greatest proportion of AMS/AMR abstracts representing 20% (732/3669) of all abstracts (UK 66%; 80/121 & international 18%; 652/3548; p<0.0001). AMS/AMR coverage across all general specialties was poor (intensive care 9% [116/1287], surgical 0.01% [8/757] and medical specialties 0.64% [332/51497]) despite high usage of antimicrobials across all.

Conclusion
Despite current AMR/AMS strategies being advocated by infection specialists and discussed by national and international policy makers, AMS/AMR coverage remains limited across specialty scientific conferences in 2014. We call for further intervention to ensure specialty engagement with AMS programmes and promote the AMR agenda in clinical practice.

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Introduction

Antimicrobials are almost unique in terms of commonly prescribed medications. The limited pool, the lack of new development in the field, and the ongoing increase of resistance is seriously compromising their therapeutic value. Global estimates of increasing mortality secondary to infection with multi-drug resistant organisms has led to calls for immediate global action to avoid an “apocalyptic threat” akin to that of climate change. Central to these proposed strategies is the development of robust antimicrobial stewardship (AMS) programmes aiming to maximise treatment outcomes, whilst minimising negative factors, such as resistance and antimicrobial toxicity.

In terms of promotion and uptake of AMS in clinical practice, much work has already demonstrated that restrictive AMS measures provide adequate short term outcomes on prescribing behaviour. However, it remains clear that long term success in AMS requires a multifaceted approach to develop a positive culture of change, which empowers staff (through innovation and improvement of routine care) to help bridge the gap between best and actual practice. Development of this culture is likely to involve targeted educational intervention, promotion of sustainable behaviour change, and development of clinical leaders across all specialties. Whilst AMS is now an important policy component for infection specialists, it has been suggested that the message is still failing to reach other (non-infection specialist) prescribers who are responsible for high rates of antimicrobial use.

Implementation of the five year antimicrobial strategy in the United Kingdom (UK) in 2013 has stressed the need for involvement of all healthcare professionals across the UK in antimicrobial stewardship. This need for cross-disciplinary engagement has been echoed by the World Health Organisation (WHO) and the United States Centre for Disease Control (US CDC). To explore the degree to which medical professionals from different
disciplines have engaged with the issue of AMS, we undertook a cross-sectional observational study analysing coverage of antimicrobial resistance (AMR) and AMS (focusing on antibacterial agents) among UK and international medical scientific conferences as a surrogate marker for current awareness and attributed importance.

**Method**

All major specialties recognised by the Royal College of Physicians, London, UK, were identified and included alongside general surgical, psychiatric, paediatric and obstetrics and gynaecology specialties. UK specialists (specialist trainees or consultants) in each of the defined fields were consulted by email to determine the largest medical scientific/research conference (a) within the UK and (b) internationally for inclusion. Educational, continuing professional development and sub-specialty conferences were not considered for inclusion given their often focused agendas, which may have added biased our findings. Conferences held in 2014 were identified, and their characteristics collated including: location, conference dates, estimated attendance and total number of abstracts accepted (either as oral, poster or publication only). Accepted conference abstracts (invited, oral, poster and publication only) were then identified and interrogated using specified search criteria (Panel 1) to identify all abstracts relating to AMS and AMR.

All identified abstracts from the search were then reviewed by two of the authors (TMR & LSPM). Abstracts were included if they were deemed to be describing an aspect of AMS\(^6\) or AMR\(^4\) in terms of direct effect on patients. In vitro studies with no translational benefit to individual patients were excluded. For the purpose of our investigation we focused on bacterial resistance and stewardship, abstracts relating solely to antiviral, antifungal, antipROTOZOAL or antimycobacterial resistance were excluded. This focus was selected given that anti-bacterial agents make up over 93% of all antimicrobials prescribed for systemic
Furthermore, the large variation in prescribing of other antimicrobial classes across different specialties may have influenced our results.

Following identification of all relevant abstracts at the UK and international conferences, sub-group analysis was performed and proportions of abstracts highlighting AMS and AMR for each conference were compared. For statistical analysis, chi-squared with Yates correction or Fishers exact test were performed where appropriate.

Data on conference abstracts was then contrasted against (i) the proportion of patients in each specialty on antimicrobials and (ii) the proportion of patients who acquire healthcare associated infections (HCAI) within each specialty using data from the European Centre for Disease Prevention and Control (ECDC) point-prevalence survey conducted in 2011/12. Each specialty was ranked based on the proportion of HCAI and proportion of AU per population, respectively. The range of HCAI and AU was calculated and based on this range specialties were then assigned “risks” (high, medium or low) based on which third of the overall range for HCAI and AU they fell within, respectively. The aim of this stratification was to investigate whether it might highlight specialties where high risk is contrasted with low conference awareness.

Ethics approval was not required for this observational study.

Results

In total, 45 conferences from 23 specialties were selected for analysis (Table S1, available as supplementary data). This represented 167 conference days (median length = 4 days [range 2-6]), which involved 244,754 delegates (median = 2298 delegates/conference [range 400-34,750]), and a total of 59,682 accepted abstracts (median = 465 abstracts per conference...
Figure 1 provides detail of the abstract identification and review process. In total, 1,163 abstracts met our inclusion criteria for analysis.

Analysis of the proportion of AMS/AMR abstracts identified within each specialty conference demonstrated marked variation in the inclusion and consideration of this field among respective state-of-the-art/leading conferences (Figure 2). Infection conferences contained the highest proportion of AMS/AMR abstracts representing 20% (n=732/3669) of all abstracts at the two conferences in this specialty. In comparison, intensive care had the second greatest proportion of AMS/AMR abstracts with 9% (116/1287), geriatrics followed with 8% (n=17/220), genitourinary medicine had 7% (45/672), and paediatrics included 5% (n=50/915). All other specialties proportion of AMS/AMR abstracts were <5%. All specialties had significantly lower proportion of AMS/AMR abstracts within their conferences (p<0.0001) in comparison the specialty with the greatest proportion of coverage (infection conferences).

Comparison between UK and international conference abstracts for each specialty demonstrated several significant differences in AMS/AMR coverage. Overall, AMS/AMR abstracts accounted for a significantly greater proportion (p<0.0001) of total abstracts at UK conferences (2.8%; n=221/7843) than international conferences (1.8%; n=942/51839) during 2014, but variation existed in the frequency with which specialties covered this topic in the UK versus elsewhere. Within infection specialty conferences, there was a significantly greater proportion of AMS/AMR abstracts at UK conferences (66%; n=80/121) than internationally (18%; n=652/2896) (p<0.0001). Furthermore, primary care (UK 12/408 & international 16/1846; p=0.0015), general surgery (UK 7/340 & international 1/417; p=0.026) and anaesthetics (UK 5/156 & international 1/510; p=0.003) conferences in the UK had significantly greater proportion of AMS/AMR abstracts compared to their international equivalents. In contrast, geriatrics (UK 4/66 & international 13/154; p<0.0001) and
genitourinary medicine (UK 25/492 & international 20/180; \(p=0.009\)) had significantly
greater inclusion of AMS/AMR abstracts internationally compared to its UK equivalent.
However, our observation of genitourinary medicine may have been due to the UK
genitourinary conference (BASHH) being joint with the annual British HIV Association
(BHIVA) conference in 2014 which may have reduced the total number of abstracts available
for consideration given exclusion of antiviral abstracts from this analysis.

In primary care, we observed that state-of-the-art conferences only included 28/2254
abstracts (1.2%) on AMS/AMR in 2014. This is in the context of the 2014 English
surveillance programme for antimicrobial utilisation and resistance (ESPAUR) report
detailing that 78.5% of all antimicrobial prescribing in the UK was performed by primary
care.\(^\text{15}\) Within secondary care specialties, coverage of AMS/AMR remains markedly low at
leading conferences (intensive care 9% \([116/1287]\), surgical 0.01% \([8/757]\) and medical
specialties 0.64% \([332/51497]\)). Again this is in the context of high rates of antibacterial
prescribing within these fields, with surveillance reports indicating that over 50% of patients
in intensive care, 30% of surgical patients and 25% of medical patients are prescribed
antimicrobials in secondary care.\(^\text{12,14}\)

On interrogation of point-prevalence data for AU and HCAI for each different specialty, three
points become clear. First, among those specialties who demonstrate the highest awareness of
AMS/AMR in their conferences (i.e. infection/microbiology, intensive care, geriatrics and
paediatrics) it is apparent that they are medium to high users of antimicrobials with variable
rates of HCAI. Second, there is a stark absence of awareness in conferences among a
significant number of specialties who demonstrate high AU and/or high HCAI (e.g.
haematology and nephrology). Third, among some specialties (e.g. ophthalmology, general
practice and obstetrics and gynaecology) who actually had low AU and/or low HCAI, there
was relatively high engagement with demonstrable awareness among these specialties conferences.

Discussion

We have demonstrated a significantly low coverage of AMS/AMR among some of the leading scientific conferences across most major clinical specialties in 2014. This is despite AMR being considered a global threat to health, the implementation of national and international campaigns to promote AMS programmes, and high rates of antimicrobial use across all specialties. Furthermore, internationally the importance attributed to AMS/AMR was significantly lower than in the UK in 2014.

There are several factors which may explain the variation observed in coverage of AMS/AMR by clinical specialties. These may include variation between disciplines in the types of antimicrobials regularly used and the financial implications associated with this. This may be further influenced by the subsequent variation in actual or perceived risk of ineffective antimicrobial prescribing between specialties. For example, this may be in terms of being perceived to “undertreat” critically ill patients or avoiding broad spectrum antibiotics associated with high rates of Clostridium difficile in geriatric populations.\(^{(16)}\)

Given the continued rise in antimicrobial resistance\(^{(5)}\) and the importance being placed upon multi-specialty involvement in AMS programs\(^{(11)}\) a failure to engage the majority of medical specialties with this topic at their scientific conferences is concerning. Globally, implementation of AMS programmes varies greatly between countries\(^{(17)}\). Despite the high profile national and international AMS campaigns implemented in countries such as the UK, USA and Australia, broader international AMS collaboration is required, especially in terms of promoting shared research, clinical leadership and sustainable behavioural change within all professions and specialties of health care providers.
With AMR and effective stewardship a key patient safety agenda, there is a need to promote clinical leaders across all specialties to drive behavioural change through creation of a positive, open culture of engagement on the subject. This need has led to a shift in key beliefs, values and techniques towards the use of behavioural sciences in AMS.\(^{(16)}\) Such behavioural interventions have targeted the prescriber, patients and other non-prescribing allied health care professionals, basing their interventions upon firm theoretical frameworks and theories.\(^{(16)}\) Whilst these interventions may potentially lead to reductions in AMR, the current paucity of AMS/AMR coverage among the majority of scientific conferences for non-infection specialties indicates urgent action is needed within the medical world itself, rather than continued focus on the rest of society, patients and public.

Contrasting conference AMS/AMR awareness against HCAI risks and AU among different specialties enables policy level prioritisation for future initiatives to improve awareness and promote engagement with AMS programmes within these “high risk” specialties. Furthermore, it provides a basis for debate about indicators of progress. An exceptional case in this argument is primary care, where the cost of antimicrobials is low in comparison with other drugs and the immediate threat to patients from ineffective or excessive antimicrobial prescribing is also low. Engagement with specialist societies in primary care is going to require political support to raise the importance of antimicrobial prescribing as a quality indicator. Of particular note, currently antimicrobial prescribing does not feature at all in the UK Quality and Outcomes Framework for primary care.\(^{(18)}\)

There is evidence to support encouraging active engagement in AMS/AMR through conferences in place of passive measures to promote education and behavioural change.\(^{(19)}\) Medical conferences provide opportunity for medical professionals to participate in research and reporting, providing an educational benefit \(^{(1)}(19)\) and also provides a platform for key
opinion leaders and organisations to promote their current key agendas. Clear strategy and mechanisms for implementation are required by actors in the fields of AMS/AMR to actively engage non-infection specialties. This may be by establishing AMS/AMR as a consistent and visible presence within non-infection journals and conferences to broaden those reached and promote collaborative research within this area. The aim being for AMS to be adopted and self-governed from within all specialties who continue to regularly prescribe antimicrobial agents.

Our observation of significantly greater AMS/AMR abstracts in UK compared to international conferences is difficult to explain given implementation of numerous, similar, high profile, AMS programmes globally. In the UK the five year antimicrobial strategy and “start smart and focus” AMS campaign UK are comparable to programmes run by the US CDC in the USA and the Australian Commission on Safety and Quality in Health Care (ACSQHC). Further investigation of specific strategies which target multi-professional and multi-specialty involvement in AMS within the UK compared to other countries may be warranted to identify differences responsible for our observations.

There were several limitations to our study. Firstly, we relied on specialist opinion to confirm relevant conferences (both UK and international), which may have led to selection bias based on individual preferences. To address this we ensured that where there was disagreement or multiple options, the conference with the largest attendance was selected. The selection of only large state-of-the-art conferences may have also narrowed the range of conferences available for inclusion. However, by selecting high profile national and international conferences, we believe that would provide the most broad representation of attributable importance to the subject within that specialty, as they would avoid including narrow agendas often found within sub-specialist, smaller conferences, which may have either positively or
negatively influenced our observations. Furthermore, in a few instances data was not available from conference websites / journals meaning that the conference was excluded from our final analysis (i.e. clinical & experimental dermatology (22), international conference on emergency medicine, (23) association of British Neurologists, (24) European society of ophthalmology, (25) and association for palliative care medicine (26)). Finally, we have used conference presentations as a surrogate marker for current awareness and importance of AMS/AMR within a specialty. Whilst this provides an insight into the subjects currently deemed important by the specialty, it may also underestimate current awareness on certain topics.

In conclusion, with the ongoing development of international frameworks for AMS implementation and evaluation, it is vital that clinical engagement and involvement of clinical leaders across all disciplines is encouraged and monitored. This will promote self-governance of stewardship programmes and support targeted research within specialties, helping to maintain ongoing support for AMS from both local and international policy makers. Discerning clear interventions to promote engagement of the AMS agenda within medical specialties is urgently required, as is a mechanism to prospectively assess their effectiveness; we suggest AMR/AMS coverage at state-of-the-art medical conferences may act as a useful proxy indicator.
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**Transparency declaration**

A.H.H. and L.S.P.M have consulted for bioMérieux. M.J.G. reports attending advisory boards for The Medicines Company and Cubist, and receiving educational travel and speaker grants from Eumedica Pharmaceuticals and Astellas Pharmaceuticals respectively. T.M.R has no conflicts of interest to declare.
References


Panel 1: Accepted conference abstract search criteria and definitions

Abstract search criteria:

I. Anti* (wildcard search accepting antibiotic, antimicrobial or similar)
II. Resist* (wildcard search accepting resistant, resistance or similar)
III. Infect* (wildcard search accepting infection, infective, infected or similar)
IV. Stewardship

AMS and AMR definitions:

AMS: “Optimising the indication, selection, dosing, route of administration and duration of antimicrobial therapy to maximise clinical cure or prevention of infection while limiting the collateral damage of antimicrobial use, including toxicity, selection of pathogenic organisms and emergence of resistance”

AMR: “Resistance of an organism to an antimicrobial drug that was originally effective for the treatment of infections caused by it”

AMS = Antimicrobial Stewardship; AMR = Antimicrobial Resistance
Figure 2. Antimicrobial stewardship and/or antimicrobial resistance related abstracts from UK and international state-of-the-art medical scientific conferences in 2014.

* UK significantly greater than international conferences (p<0.05)

# International significantly greater than UK conferences (p<0.05)

+ International data not available for statistical analysis

Risk score: H = high, M = medium, L = low (Calculated from The European Centre for Disease Prevention and Control (ECDC) pilot point prevalence survey of healthcare-associated infections and antimicrobial use data)
**Figure 1.** Selection method to identify antimicrobial stewardship/antimicrobial resistance abstracts among state-of-the-art conferences in 2014.

- **Abstracts identified for review**
  
  \( (n = 59,682) \)

- **No duplicates identified**
  
  \( (n = 59,682) \)

- **Abstracts identified using electronic search criteria described in panel 1**
  
  \( (n = 9210) \)

  - **Records NOT detailing AMR/AMS using electronic search criteria described in panel 1**
    
    \( (n = 50,472) \)

  - **Abstracts detailing AMR/AMS (as defined in panel 1)**
    
    \( (n = 1,163) \)

  - **Records NOT detailing AMR/AMS (i.e. did not meet inclusion criteria) following full review of abstract**
    
    \( (n = 8,047) \)
### Supplementary table 1: Conference characteristics and abstract data for UK and international state-of-the-art medical scientific conferences, 2014.

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n/a = not accessible, ID = Infectious Diseases, GB = Great Britain, BASHH = British Association of Sexual Health and HIV, BHIVA = British HIV Association, STI = Sexually transmitted infection, O&G = Obstetrics and Gynaecology
Supplement references


