Conference Paper

Antibacterial usage in English NHS hospitals as part of a national Antimicrobial Stewardship Programme

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Abstract

Antimicrobial resistance (AMR) has become a global problem for health care services, with fewer antimicrobials entering the market and some pathogenic organisms becoming resistant to commonly used antimicrobials. Antimicrobial stewardship (AS), including evidence-based standard setting, education and communication, and audits of practice, has become a key method of preventing the rise in the rise in AMR. Data on antibiotic consumption are often obtained through prospective and retrospective point prevalence audits of antibiotic usage, but such studies are very resource intensive and only provide a snapshot of consumption. The objective of the study reported here was to examine longitudinal total antibacterial usage at a national level and cross-sectional usage at an individual hospital trust level using a commercial database that captures antimicrobial prescribing from at least 99% of English hospital Trusts.

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A full list of members of the Antimicrobial Stewardship Sub-Group of the Department of Health’s Advisory Committee for Antimicrobial Resistance and Healthcare Associated Infection who have supported the development of the paper, and their transparency declarations, appears in Appendix 1 at the end of the paper.

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Background

Antimicrobial resistance (AMR) has become a global problem for health care services, with fewer antimicrobials entering the market and some pathogenic organisms becoming resistant to commonly used antimicrobials. Antimicrobial stewardship (AS), including evidence-based standard setting, education and communication, and audits of practice, has become a key method of preventing the rise in AMR. Over the past 10 years, the UK has seen a number of national initiatives to promote AS and address the rise in AMR. Examples include Essential Steps to Safe, Clean Care: Reducing Healthcare-Associated Infections; Saving Lives; The SACAR Antimicrobial Framework; Clostridium difficile Infection: How to deal with the Problem; Clean, Safe Care: Reducing Infections and Saving Lives; The Health and Social Care Act 2008, Code of Practice; Start SMART then FOCUS and the UK Five-Year Antimicrobial Resistance Strategy.

Although the importance of measuring antimicrobial consumption has repeatedly been highlighted, particularly in secondary care, the ability to undertake such analysis has been hampered by the lack of readily available data and, until recently, analysis of antibiotic acquisition costs has been the only way to estimate usage. Electronic prescribing (EP) and electronic medicines administration have the potential to provide better data, with patient-linked information on antimicrobial selection linked to diagnosis, microbiological results and outcomes. But fewer than 10% of English NHS hospitals have EP in place. Moreover, among hospitals that have implemented EP, there is a lack of standardized data husbandry.

Data have also been obtained through prospective and retrospective point prevalence audits of antibiotic usage, but such studies are very resource intensive and only provide a snapshot of consumption. The objective of the study reported here was to examine longitudinal total antibacterial use at a national level and cross-sectional usage at an individual hospital trust level using a commercial database that captures antimicrobial prescribing from at least 99% of English hospital trusts.

Method

Hospital pharmacies in England provide aggregate monthly data on all medicines issued to patients, wards and clinics to IMS, a leading provider of information, services and technology for the health care industry, through an agreement that reimburses the hospital trusts for these data. As well as in-patient prescribing, IMS data also include outpatient prescribing from hospitals, genitourinary medicine (GUM) clinics and other prescribing to ambulatory patients. Occupied Bed-Days (OBD) data were obtained from Hospital Episode Statistics. Data on issues of antimicrobials to wards, clinics and so on were converted to WHO Defined Daily Doses (DDDs). Where DDD data were not available then Average Daily Quantities (ADQ) were used.

Results

Longitudinal analysis

The five-year trend in total antibacterial use in English hospitals between 2008 and 2012 is shown in Fig. 1. There was a 4.1% increase in total usage over this time period. Fig. 2 shows the changes in groups of antibacterials. There was a marked increase in the use of co-amoxiclav (+56.6%) and, aminopenicillins, (amoxicillin and ampicillin: –12.6%). Fig. 4 shows the reduction in the use of cephalosporins with a fall in first-generation cephalosporins (cefodoxil, cefalexin and cefradine: –40.7%), second-generation cephalosporins (cefaclor and cefuroxime: –54.7%) and third generation cephalosporins (cefixime, cefotaxime, ceftodoxime, cefazidime and ceftriaxone: –4.3%). There was also a fall in fluoroquinolones, mainly oral ciprofloxacin (–23.8%).

Counterbalancing these reductions, there was a substantial increase in the use of carbapenems (94.8%), mainly meropenem, and also in the use of broad-spectrum antipseudomonal penicillins, particularly piperacillin/tazobactam (142.3%).
Cross sectional usage of antibacterials in 2011–12

The usage of antibacterials across all English NHS hospitals – corrected for annualised activity per 1000 occupied bed days - showed considerable heterogeneity (Fig. 7). This wide general variation and, more specifically, the considerable variation in carbapenems as a proportion of trusts’ total usage, offer further opportunities for analysis (Fig. 8). The relationship between the consumption of cephalosporins and fluoroquinolones is shown in Fig. 9, with horizontal and vertical lines describing the 75th percentile of the population of hospitals, revealing little general relationship though with a few outliers having high use of both classes.

Discussion

Such a small increase in total antibacterial use would not be expected as, during this five-year period, there was an increase in patient throughput of over 17%. By contrast, the reduction in the usage of cephalosporins and quinolones is unsurprising, as a number of national initiatives have focussed on reducing the numbers of Clostridium difficile infections (CDI).6 There are national and local targets for CDI reduction to which all hospital trusts must agree and many sites have sought to meet these by addressing the use of antibiotic classes particularly associated with the selection of C. difficile, such as cephalosporins. The reductions in the use of cephalosporin and fluoroquinolone follow on from observations made in previous years when considerable reductions in the usage of these agents were already being recorded.14
Clearly, when there is a reduction in the use of one group of antibacterials there is often a corresponding increase in the use of others. In this case, a nearly 60% increase in co-amoxiclav use was observed. Of even greater concern was the marked increase in the use of anti-pseudomonal penicillins and carbapenems; these shifts are disturbing, particularly when there are global concerns about the increase in carbapenemase-producing pathogens, which are resistant to these agents.15

The marked heterogeneity of antibacterial use between different English hospitals seen in the cross-sectional analysis is of particular interest. This heterogeneity might be explained by differences in hospital specialities. Hospitals that have a similar mix of medical and surgical specialties would be expected to have similar proportions of antibacterial usage, unless there were differences in the levels of antimicrobial stewardship between hospitals. By contrast, those hospitals that have certain specialties, such as cystic fibrosis, cancer or renal units, might be expected to show different patterns of usage.

Comparison with other countries shows that antibiotic usage in England is greater than in France16 and Australia.17 It is difficult to compare with antibiotic use in US hospitals as they do not use the same usage units.18 A confounder is that the English data include out-patient (ambulatory) usage which is not included in hospital data by other groups. Clearly, more work is required to validate these findings, but they illustrate an opportunity for hospitals to benchmark themselves against other similar units.

Such benchmarking might prove a useful marker of antimicrobial stewardship. The new national programme, the English Surveillance Programme for Antimicrobial Utilization and Resistance (ESPAUR), led by Public Health England will work to ‘bring together the elements of antimicrobial utilization and resistance surveillance in both primary and secondary care settings, alongside the development of quality measures and methods to monitor unintended outcomes of antimicrobial stewardship and both public and professional behaviour interventions’.17

Conclusion

Longitudinal analysis of antimicrobial consumption offers a useful instrument for observing trends in consumption time for individual hospitals, groups of hospitals or whole countries. Cross-sectional analysis of usage between hospitals within defined time periods can be helpful in benchmarking usage within countries. Both methods are essential for informing antimicrobial stewardship programmes.

Author statements

Ethical approval

There was no requirement for any Ethical Approval.

Funding

No funding of any kind has been received for this work.

Competing interests

See Appendix 1.

REFERENCES


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Transparency declarations

JC Chaired the Antimicrobial Stewardship Sub-Group of the Department of Health Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection. (Travel expenses only). Has Chaired, presented and received honoraria at meetings supported by Astellas, HHI and Alere. Honoraria received.
PS – is employed by IMS Health. IMS Health provides information services to the pharmaceutical industry and governments, including the manufacturers of antibiotics and the Department of Health.
DAO – none declared.
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CF – none declared.
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APJ is Editor-in-Chief of the Journal of Antimicrobial Chemotherapy.

DML is partly self-employed and consults for numerous pharmaceutical and diagnostic companies, including Achagen, Adenium, Allocra, Astellas, AstraZeneca, Bayer, Basilea, bioMerieux, Cubist, Curetis, GSK, Kalix, Merck, Meiji Seika, Pfizer, Roche, Tetraphase and Wockhardt; he holds grants from Basilea, Cubist, Meiji Seika, Merck; has received lecture honoraria or travel reimbursement from AstraZeneca, Curetis, GSK, J&J, Merck, Novartis, Pfizer and Tetraphase and holds shares in Dechra, Eco Animal Health, GSK, Merck and Pfizer, collectively amounting to <10% of portfolio value.
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Appendix 1

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