

Pilot study for a cluster randomised trial of a prescribing intervention to reduce risk of hospital acquired infection with *Clostridium difficile* in older patients

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Executive summary

Aim: To assess the feasibility of a cluster randomised trial of the effectiveness, safety and cost-effectiveness of a conservative antibiotic policy¹ in Medicine for the Elderly units.

Project outline/methodology: Point prevalence survey of all patients in 42 Care of the Elderly wards in five Boards. Standard forms were used to collect data about antibiotic use, infection control practice and case definition of *C difficile* infection.

Key Results: There were 950 patients and 175 (18%) were receiving systemic antibacterial drugs. The overall prevalence of antibiotic use and rank order by Board were similar to a national survey in the previous year. Our survey provided additional detail about dosing. We showed that prescribed daily doses were similar to the WHO defined daily dose for most antibiotics and endorsed this unit of measure for the Hospital Medicines Utilisation Database, which is expected to be available in 2010. The prevalence of antibiotic use and *C difficile* infection were significantly higher in Acute Wards than in Assessment, Rehabilitation and Long Stay Wards. Prevalence of antibiotic use was 26% *versus* 16%, OR 1.93, 95% CI 1.36 to 2.73 prevalence of *C difficile* infection was 4.8% *versus* 2.0%, OR 2.46, 95% CI 1.12 to 5.39. Acute Wards should be the priority for antibiotic policy intervention but this should be integrated with Acute Medical Admission Units. Further research is required on the risks of antibiotic use in Assessment, Rehabilitation and Long Stay Wards.

Conclusions: Our results support a quasi-experimental intervention study with interrupted time series analysis of the impact of the conservative antibiotic policy. The primary process outcome should be measured from routine data about antibiotic use that will be available for all hospitals from 2010. Clinical outcomes should be *C difficile* infection and 30 day mortality, which can also be measured from routine data.

What does this study add to the field: Previous surveys have documented the prevalence of antibiotic use but not the doses prescribed. This new information will inform the interpretation of Scotland's Hospital Medicines Utilisation Database and its use for measurement of the impact of intervention to change antibiotic use. Moreover our survey has provided new information about the case mix in Care of the Elderly Wards that will inform the interpretation of prevalence surveys of Hospital Acquired Infection.

Where to next?: Intervention to change prescribing is likely to have the biggest impact on *C difficile* if it is targeted at Acute Medical Admissions Units in addition to Acute Care of the Elderly wards.

Our data support measurement of antibiotic use in WHO Defined Daily Doses for evaluation of interventions with the Hospital Medicines Uses Database once this is fully operational

Aim

To assess the feasibility of a cluster randomised trial of the effectiveness, safety and cost-effectiveness of a conservative antibiotic policy¹ in Medicine for the Elderly units.

Antibiotic Policy Change

The conservative antibiotic policy that was implemented at the Royal Free Hospital¹ was

Respiratory Tract Infection: Benzyl penicillin + trimethoprim (iv) or amoxicillin

Urinary Tract Infection: Trimethoprim oral or IV or IV gentamicin for severe sepsis

Septicaemia: Amoxicillin plus gentamicin +/- metronidazole +/- flucloxacillin

Cellulitis: Flucloxacillin plus benzyl penicillin

Aspiration: Benzyl penicillin plus metronidazole

Methods

Point Prevalence Surveys of Antibiotic Use

Two investigators (CM and PD) visited each hospital to collect data on each ward about the total number of patients in the ward, the number of patients who were receiving antibiotics at 8am on the day of survey and details of the antibiotics prescribed. We restricted the survey to systemic antibacterial drugs and did not include antifungal or antiviral drugs. Data items that were collected were:

1. Unit Dose
2. Doses per day
3. Route (IV injection or oral)
4. Diagnosis (anatomical site)
5. Indication (community acquired, hospital acquired or prophylaxis)
6. Reason for therapy in notes

We obtained data about the same wards from the National Point Prevalence Survey of Hospital Acquired Infection conducted in 2006 by Health Protection Scotland.² The HPS national survey collected data about any patient who was receiving systemic antimicrobial drugs on the day of survey, for community acquired or hospital acquired infection. The HPS survey included all systemic antimicrobials (antifungal and antiviral in addition to antibacterial drugs).

We analysed drug use in Prescribed Daily Doses and in WHO Defined Daily Doses (DDD). The DDD is intended to facilitate international comparison of drug use and is based on the commonest dose prescribed to adults.³ For comparison with Prescribed Daily Doses we calculated the number of WHO DDD for each drug by summing the total quantity prescribed to all patients and dividing by the WHO DDD for that drug.

Hospital Medicines Utilisation Database (HMUD) for Longitudinal Analysis of Antibiotic Use

The anticipated delivery date for this database was early 2008. By the end of 2007 it was apparent that the data processing was much more complex than originally anticipated and we requested an extension of the pilot project to the end of June 2009. However, there are still technical problems with obtaining consistent data from all hospitals in Scotland. An option appraisal for two potential solutions is currently being considered by ISD but the earliest delivery date for the database is now 2010. After further discussion with Peter Craig at CSO it was agreed that the pilot project should finish at the end of June 2009 so that report on the point prevalence surveys could be submitted to the next HSR Committee. Once the HMUD database is operational the point prevalence survey data collected in 2007 will be used to interpret longitudinal data from participating hospitals.

Case Definition of Clostridium difficile Infection and Infection Control Practice

We used a questionnaire to record the case definition of *C difficile* infection and details of infection control practice in the previous two years. Key issues were the methods used to ascertain diarrhoea, the policy for retesting patients and the methods used to distinguish between relapse and re-infection. A standard questionnaire was submitted to each hospital's infection control team and microbiology department before the site visit and issues of interpretation were resolved at the site visit.

Statistical Analysis

We used Yates' correction for calculation of Chi-square with two by two tables and calculated 95% CI for Odds Ratios.⁴

Results

Point Prevalence Surveys of Antibiotic Use

Description of Hospitals and Ward Types

We collected data from 42 wards with 1,026 beds in seven hospitals from five Health Boards (Table 1). Four of the Boards had Care of the Elderly Wards that took acute admissions directly or within 24 hours of admission to the Acute Medical Admissions Unit (Table 1). At the time of the survey in Tayside patients were only transferred from acute medicine to Care of the Elderly Wards for rehabilitation, once acute medical problems had been resolved.

Each of the Boards used different labels for their other Wards:

- Glasgow: long stay, pre-discharge, rehabilitation or stroke
- Grampian: assessment, long stay or rehabilitation
- Lanarkshire: complex needs, rehabilitation or stroke
- Lothian: rehabilitation or stroke
- Tayside: assessment, long stay or rehabilitation

For further analysis we have grouped these wards together as Assessment and Rehabilitation and Long Stay (A&R&LS)

Comparison with HPS National Survey

The total number of patients in all wards on the survey days was 950, of whom 175 (18%) were receiving systemic antibacterial drugs (Table 2). The total number of patients in the wards and prevalence of antibiotic use were similar to the HPS National Survey in the previous year (Table 2). The rank order of prevalence of use by Board was the same in both surveys (Table 2). The prevalence of antimicrobial use for each Board was higher in the HPS National Survey than in our Survey (Table 2). This is likely to be explained at least in part by the fact that the HPS Survey included all antimicrobial drugs, whereas our survey only included antibacterial drug. The HPS data collection only included the prevalence of patients who received any antimicrobial and the number of patients who received each drug. It was not possible to calculate the prevalence of antibacterial use because the Survey did not document whether a patient who received an antifungal or antiviral drug also received an antibacterial drug. Antiviral and antifungal drugs accounted for 9% of all prescriptions in the HPS survey, range from 4% to 18% in the survey wards.

Details of Antibiotic Use

The prevalence of antibiotic use was significantly higher in Acute wards (66/251, 26.3%) *versus* A&R&LS wards (109/699, 15.6%), OR 1.93, 95% CI 1.36 to 2.73, Chi-square 13.37, $p < 0.001$.

There was a total of 199 prescriptions for antibacterial drugs, 33 for IV administration (Table 3) and 166 for oral administration (Table 4). The patients received 10 different IV drugs but the top three drugs (ceftriaxone, co-amoxiclav and metronidazole) accounted for 58% of all prescriptions for IV drugs (Table 3) and were the top three drugs in both Acute and A&R&LS wards (Table 3). The drugs that were restricted at Royal Free

Hospital (cephalosporins, ciprofloxacin, clarithromycin and co-amoxiclav) accounted for 58% of all IV drugs overall, 58% in Acute wards and 57% in A&R&LS wards (Table 3).

The patients received 20 different oral drugs but the top five drugs (trimethoprim, co-amoxiclav, ciprofloxacin, metronidazole and clarithromycin) accounted for 68% of all prescriptions for oral drugs (Table 4) and were the top five drugs in both Acute and A&R&LS wards (Table 4). The drugs that were restricted at Royal Free Hospital (cephalosporins, ciprofloxacin, clarithromycin and co-amoxiclav) accounted for 40% of all oral drugs overall, 42% in Acute wards and 39% in A&R&LS wards (Table 3).

Overall the number of actual daily doses and calculated daily doses from WHO DDD was similar for drugs administered IV or orally (Table 5). However, the relationship varied considerably between drugs. For most drugs there was a range of actual daily doses that included the WHO DDD (Table 5). However, for a minority of drugs there was a consistent difference between actual daily dose and WHO DDD, for example the actual daily dose for oral clarithromycin was always twice the WHO DDD (Table 5). The % difference between actual daily dose and WHO DDD varied considerably but overall the WHO DDD over-estimated consumption by 8% for IV drugs and 1% for oral drugs. The difference between actual daily doses and calculated daily doses was greater for the drugs restricted by the Royal Free antibiotic policy (Table 5). The rank order of drug use by Board was the same when ranked by prevalence, prescribed daily doses or calculated WHO DDD (data not shown). Drug use in acute wards was approximately two-fold greater than in A&R&LS wards by all three measures (Table 6).

Diagnosis and Indication

Of the 175 patients that received antibiotics, 163 (93%) were being treated for infection of which 43 (26%) were community acquired and 120 (74%) were hospital acquired. The remaining 12 patients were receiving prophylactic antibiotics. The commonest anatomical site was pneumonia for community acquired infection whereas it was the urinary tract for hospital acquired infection and prophylaxis (Table 7). There were 27 gastrointestinal infections of which 26 were *C difficile* infections, the remaining patient had biliary tract infection. Gastrointestinal infection was the second commonest cause of Hospital Acquired Infection (25/120, 21%, Table 7).

Of the 163 patients who were being treated for infection 65 were in Acute Wards and 98 were in A&R&LS wards. In comparison with A&R&LS wards, infections in acute wards were significantly more likely to be community acquired (30/66, 46% *versus* 13/98 Chi square 20.1, $p < 0.001$). The indication for antibiotic therapy was more likely to be included in notes of patients from acute wards (60/66, 91%) *versus* A&R&LS wards (87/109, 80%), consequently more infections in A&R&LS wards were from unknown sites (Table 8). The urinary tract was the commonest site of infection in acute and A&R&LS wards but the second commonest site was pneumonia in acute wards *versus* gastrointestinal infections in A&R&LS wards (Table 8). In comparison with acute wards a significantly higher proportion of patients treated for "urinary tract infection" in A&R&LS wards had asymptomatic bacteruria with no clinical record of symptoms of infection (10/35, 29% *versus* 2/21, 9%, Chi-square 4.1, $p < 0.05$).

The overall prevalence of *C difficile* infection was higher in acute wards (12 cases in 251 patients, 4.8%) *versus* A&R&LS wards (14 cases in 699 patients, 2.0%). The odds ratio for *C difficile* infection in acute wards *versus* A&R&LS wards was 2.46, 95%CI from 1.12 to 5.39.

Support for a Change in Antibiotic Policy

All Boards said that a change to the Royal Free Policy would be supported only if fully endorsed by local Medical Microbiologists and even then prescribers would only support policy change in the context of an evaluation of clinical effectiveness. In addition two Boards said that support of Acute Physicians and Respiratory Physicians would be required and the policy would need to be implemented on the Acute Medical Admission Unit as well. One Board said that considerable education of medical staff would be

required for safe administration of gentamicin. Clinicians were most concerned that the Royal Free Policy would not be as effective as their current policy for the treatment of pneumonia.

Impact of Change in Antibiotic Policy

One or more of the Royal Free Policy restricted antibiotics (cephalosporins, ciprofloxacin, clarithromycin and co-amoxiclav) were prescribed to nearly half of the patients who received antibiotics: 82/175 (47%) in All Wards, 32/66 (48%) in Acute Wards and 50/109 (46%) in Assessment, Rehabilitation and Long Stay (A&R&LS) Wards.

Implementation of the Royal Free Policy would have reduced use of the restricted drugs by 84% (from 82 to 13 patients) in all Wards, by 97% (from 32 to 1 patient) in Acute Wards and by 76% (from 50 to 38 patients in A&R&LS Wards (Table 10). This is an underestimate of the potential impact of the policy because 10 (77%) of the remaining 13 patients who received policy restricted drugs had unknown diagnosis (n=7) or received the drugs for urinary prophylaxis (n=3). The remaining three patients had biliary sepsis, discitis and surgical prophylaxis.

Case Definition of C difficile infection

Four Boards were able to provide data about number of samples tested for *C difficile*, either for the specific wards that we surveyed or for the hospital as a whole. All four Boards reported an increase in samples tested compared with the previous year, probably because of a national change in policy to mandatory testing of any stool sample from a patient aged 65 or older. There were some differences in the way that other samples were selected for testing for *C difficile* but these would not be expected to influence testing of samples from patients aged 65 or more from 2006 onwards. All Boards had a policy for not testing repeat samples from the same patient and they all recorded personal identifiers for patients who were tested for *C difficile*. Most importantly none of the Boards had made a substantial change in case definition or testing from 2006 onwards.

Infection Control Practice

Infection control practice was similar across all Boards, with isolation of any patient with diarrhoea in single rooms. No Board had an isolation ward for *C difficile* infection. All Boards did regular audits of infection control practice that included both structural and personal elements. There had been no change in the frequency or scope of audits in any Board since 2007.

Discussion

We believe that we can answer all of the original research questions, despite the fact that data from the Hospital Medicines Utilisation Database (HMUD) is unlikely to be available for all participating hospitals until 2010

1. Processes – what are the optimal measures of antibiotic prescribing and infection control processes and how can they be estimated from routine data?
 - a. The results of our survey were very similar to the national HAI prevalence survey in terms of prevalence of antibacterial use and rank order of use by Board in the wards that we surveyed (Table 2). This is important evidence about the internal validity of the point prevalence survey method for estimating and comparing antibiotic use.
 - b. The point prevalence survey data show that the WHO DDD provides a good estimate of the total number of days of treatment overall and with the drugs that were targeted by the Royal Free Antibiotic Policy (Tables 4-6). Therefore the HMUD database can be used to measure the impact of policy change on the restricted drugs.
 - c. Data about total antibiotic use after policy implementation should be interpreted with caution. Amoxicillin is one of the drugs recommended by

the Royal Free Antibiotic Policy as an alternative to restricted drugs. The prescribed dose is likely to be 3000 mg per day for severe infections, which is 3 times the WHO DDD (1000 mg). Consequently we suggest that the prescribed daily dose of 3000 mg of amoxicillin should be used for interpretation of HMUD data after policy implementation.

- d. The data we collected about case definition and infection control policies showed little practice variation across the five Boards. More importantly there were no important changes in practice in any Board since 2006, when a national policy was introduced for mandatory testing for *C difficile* in any stool specimen from patients aged 65 or over.
 - e. We have used data from Ninewells hospital for time series analysis of the relationship between antibiotic prescribing and *C difficile* using routine data.⁵ These data showed that variation in antibiotic use explained 61% of the variation in hospital acquired *C difficile* infections. Use of cephalosporins, co-amoxiclav and quinolones (drugs restricted by the Royal Free Policy) was significantly associated with *C difficile* infections.⁵
2. Outcomes – what are the optimal outcome measures, and how can they be estimated from routine data?
 - a. *C difficile* infection since 2006 is the optimal primary clinical outcome measure for an intervention to change antibiotic prescribing.
 - b. Community acquired pneumonia (CAP) was the second commonest indication for antibiotics in all wards (Tables 8 and 9). Effectiveness of the Royal Free Antibiotic Policy for CAP was the principal concern voiced by clinicians. Time series analysis of mortality from CAP has been established as an outcome measure by the Scottish National Audit Project on CAP, supervised by Scottish Antimicrobial Prescribing Group. Additional outcome measures should be 30 day mortality, both total and in patients with ICD10 codes for CAP.
 3. Centre recruitment – what are the resources needed to enlist the centres? How much central time to get the centre up and running, and how much dedicated local time will be required?
 - a. Our study suggests that routine data can be used for measurement of process (antibiotic use) and outcomes (*C difficile* infection plus mortality).
 - b. Dedicated local time will be required to implement policy change. From 2009 survey of antibiotic use for 5 patients every week is a national HEAT target and will provide evidence of policy compliance in Acute Medical Admissions Units.⁶
 4. Patient recruitment – what is the likely throughput of patients, of which how many will be eligible? What form of consent would be required for a trial?
 - a. The prevalence of antibiotic use and the indications were significantly different in Acute *versus* A&R&LS wards (Tables 4, 5 and 9).
 - b. Nearly half (46%) of the infections in Acute wards were community acquired and most of these patients were admitted via Acute Medical Admissions Units. Policy change in Acute Care of the Elderly Wards therefore needs to be part of an intervention on all patients admitted via AMAU.
 - c. A separate intervention should be designed and tested for A&R&LS wards.
 - d. Evaluation of interventions should use a quasi-experimental design, which does not require individual patient consent.⁷

5. Feasibility of antibiotic policy change – who is responsible for setting antibiotic policy in each hospital and will they support the proposed change?
 - a. The establishment of the Scottish Antimicrobial Prescribing Group has ensured that Antimicrobial Management Teams are now in place in all Boards: <http://www.scottishmedicines.org.uk/smc/6616.html>
 - b. SAPG provides a forum for national agreement and endorsement of antibiotic policy change.
6. How can collection of routine information for the trial be integrated with data currently processed by ISD?
 - a. The HMUD database will be integrated with data about prevalence of *C difficile* infection by Health Protection Scotland, who appointed a full time Pharmaceutical Adviser in 2008.
 - b. SNAP-CAP has established a mechanism for analysis of total mortality and mortality for patients with CAP through record linkage of data from ISD to the national register of deaths <http://www.snapproject.org.uk/>

Conclusions

Our point prevalence survey data show that the HMUD database can be used to monitor the impact of change in antibiotic policy in Care of the Elderly Wards. Separate antibiotic policy interventions should be designed and tested in Acute *versus* Assessment, Rehabilitation and Long Stay Wards. Interventions in Acute Care of the Elderly Wards need to be part of an intervention for all Acute Medical Admissions.

Importance to NHS and possible implementation

A copy of this report and the database will be sent to HPS and to SAPG, who are planning the next national HAI prevalence survey in 2010. This will include additional details of antibiotic dosing and our survey results will inform discussions about data collection methods and about classification of wards in Care of the Elderly

Future research

Antibiotic use and *C difficile* prevalence were significantly lower in A&R&LS wards in comparison with Acute Wards. Future research should focus on the relationship between antibiotic use and *C difficile* in these wards to define the risks of antibiotic use in this population.

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Table 1: Wards, beds and case mix by Board

Board	Hospitals	Wards	Beds	Acute	Assessment, Complex Needs, Rehabilitation and Stroke	Long stay	% Acute Beds
Glasgow	2	10	270	42	198	30	16%
Grampian	1	14	321	153	109	59	46%
Lanarkshire	1	5	136	24	84	28	17%
Lothian	2	5	132	58	74	0	44%
Tayside	2	8	167	0	137	30	0%
Totals	8	42	1026	277	602	147	24%

Table 2: Prevalence of antimicrobial use in the HPS national survey and of antibacterial use in the project surveys in ascending order of use

Board	HPS National Survey				Project Surveys			
	Survey date	Patients	Receiving Antimicrobial	Prevalence	Survey date	Patients	Receiving Antibacterial	Prevalence
Tayside	Sep 2006	151	23	15%	Aug 2007	152	15	10%
Glasgow	Aug & Sep 2006	228	46	20%	Nov 2007	255	39	15%
Grampian	Aug 2006	287	59	21%	Sep 2007	280	59	21%
Lanarkshire	Mar 2006	127	32	25%	Mar 2007	132	28	21%
Lothian	Jun & Sep 2006	115	37	32%	Oct 2007	131	34	26%
Totals	Jun-Sep 2006	908	197	22%	Aug-Nov 2007	950	175	18%

Table 3 IV drug use in Acute Wards and A&R&LS (Acute, rehabilitation and long stay) Wards

Drug	Total patients	%	Cumulative %	Acute Wards	%	Rank	A&R&LS Wards	%	Rank
Ceftriaxone	8	24%	24%	3	25%	1	5	24%	1
Co-amoxiclav	6	18%	42%	3	17%	2=	4	19%	2
Metronidazole	5	15%	58%	2	17%	2=	3	14%	3=
Ciprofloxacin	3	9%	67%	1	8%	4=	2	10%	5
Flucloxacillin	3	9%	76%	0	0%	9=	3	14%	3=
Amoxicillin	2	6%	82%	1	8%	4=	1	5%	6=
Clarithromycin	2	6%	88%	1	8%	4=	1	5%	6=
Meropenem	2	6%	94%	1	8%	4=	1	5%	6=
Gentamicin	1	3%	97%	0	0%	9=	1	5%	6=
Vancomycin	1	3%	100%	1	8%	4=	0	0%	10
TOTAL:	33			12			21		
Royal Free restricted antibiotics ¹	19	58%		7	58%		12	57%	

¹ Cephalosporins, ciprofloxacin, clarithromycin and co-amoxiclav

Table 4 oral drug use in Acute Wards and A&R&LS (Acute, rehabilitation and long stay) Wards

Drug	Total	%	Cum %	Acute Wards	%	Rank	A&R&LS Wards	%	Rank
Trimethoprim	31	19%	19%	12	19%	2	19	18%	1
Co-amoxiclav	27	16%	35%	13	21%	1	14	13%	3
Ciprofloxacin	24	14%	49%	9	15%	4	15	14%	2
Metronidazole	20	12%	61%	10	16%	3	10	10%	4
Clarithromycin	11	7%	68%	4	6%	5	7	7%	5
Amoxicillin	10	6%	74%	4	6%	6	6	6%	7
Flucloxacillin	9	5%	80%	3	5%	7	6	6%	8
Vancomycin	8	5%	84%	2	3%	8	6	6%	9
Nitrofurantoin	8	5%	89%	1	2%	9=	7	7%	6
Cephalexin	5	3%	92%	0	0%	Not used	5	5%	10
Co-trimoxazole	2	1%	93%	1	2%	9=	1	1%	12=
Penicillin V	2	1%	95%	1	2%	9=	1	1%	12=
Fusidic acid	2	1%	96%	0	0%	Not used	2	2%	11
Clindamycin	1	1%	96%	1	2%	9=	0	0%	Not used
Linezolid	1	1%	97%	1	2%	9=	0	0%	Not used
Doxycycline	1	1%	98%	0	0%	Not used	1	1%	12=
Erythromycin	1	1%	98%	0	0%	Not used	1	1%	12=
Norfloxacin	1	1%	99%	0	0%	Not used	1	1%	12=
Oxytetracycline	1	1%	99%	0	0%	Not used	1	1%	12=
Tetracycline	1	1%	100%	0	0%	Not used	1	1%	12=
TOTAL:	166			62			104		
Royal Free restricted antibiotics ¹									

¹ Cephalosporins, ciprofloxacin, clarithromycin and co-amoxiclav

Table 5 Prescribed daily doses and calculated WHO defined daily doses (DDD) for IV and oral administration

	WHO defined daily dose	Prescribed daily dose range	Actual daily doses	Calculated daily doses	Difference	% difference
IV administration						
Amoxicillin	1000	1500-3000	2	4.50	-2.50	-125%
Ceftriaxone	2000	1000-2000	8	6.50	1.50	19%
Ciprofloxacin	500	400-800	3	4.00	-1.00	-33%
Clarithromycin	1000	1000	2	2.00	0.00	0%
Co-amoxiclav	3000	1500-3000	6	5.00	1.00	17%
Flucloxacillin	2000	4000	3	6.00	-3.00	-100%
Gentamicin	240	240	1	1.00	0.00	0%
Meropenem	2000	500-1500	2	1.33	0.67	33%
Metronidazole	1500	1500	5	5.00	0.00	0%
Vancomycin	2000	375	1	0.19	0.81	81%
Totals			33	35.521	-2.52	-8%
Oral Administration						
Amoxicillin	1000	750-1500	10	13.50	-3.50	-35%
Cephalexin	2000	250-1500	5	1.25	3.75	75%
Ciprofloxacin	1000	250-1500	24	22.25	1.75	7%
Clarithromycin	500	1000	11	22.00	-11.00	-100%
Clindamycin	1200	1200	1	1.00	0.00	0%
Co-amoxiclav	1000	750-1500	27	34.50	-7.50	-28%
Co-trimoxazole	1920	480-7680	2	4.25	-2.25	-113%
Doxycycline	100	200	1	2.00	-1.00	-100%
Erythromycin	1000	1000	1	1.00	0.00	0%
Flucloxacillin	2000	1500	9	6.75	2.25	25%
Fusidic acid	1500	1500	2	2.00	0.00	0%
Linezolid	1200	1200	1	1.00	0.00	0%
Metronidazole	2000	1200	20	12.00	8.00	40%
Nitrofurantoin	200	100-400	8	8.50	-0.50	-6%
Norfloxacin	800	400	1	0.50	0.50	50%
Oxytetracycline	1000	500	1	0.50	0.50	50%
Penicillin V	2000	2000	2	2.00	0.00	0%
Tetracycline	1000	500-1000	1	1.00	0.00	0%
Trimethoprim	400	100-400	31	28.75	2.25	7%
Vancomycin	2000	500-1000	8	2.50	5.50	69%
Totals			166	167.25	-1.25	-1%
Royal Free Restricted	IV		19	17.5	1.5	8%
	Oral		67	80	-13.00	-19%
	Both		86	97.5	-11.5	-13%

Table 6 Drug use by Ward Type measured by prevalence, prescribed daily doses (PDD) or WHO defined daily doses (DDD) per 100 occupied bed days (obd).

Ward type	Occupied bed days (OBD)	Antibiotics	%	Prescribed daily doses	Calculated DDD	PDD/100 OBD	DDD/100 OBD
Acute	251	66	26%	75	82.77	30	33
A&R&LS	699	109	16%	125	121.4	18	17
Total	950	175	18%	199	204.18	21	21

Table 7 Anatomical site of infection and prophylaxis

	Infections						Prophylaxis		All Patients	
	Community Acquired		Hospital Acquired		All Infections		N	%	N	%
	N	%	N	%	N	%				
Gastrointestinal	2	4.7%	25	20.8%	27	16.6%	1	8.3%	28	16.0%
LRTI other	3	7.0%	5	4.2%	8	4.9%	1	8.3%	9	5.1%
LRTI pneumonia	17	39.5%	13	10.8%	30	18.4%	0	0.0%	30	17.1%
Sepsis, site unknown	3	7.0%	8	6.7%	11	6.7%	0	0.0%	11	6.3%
SSTBJ	2	4.7%	12	10.0%	14	8.6%	1	8.3%	15	8.6%
Unknown	1	2.3%	15	12.5%	16	9.8%	0	0.0%	16	9.1%
Urinary	15	34.9%	41	34.2%	56	34.4%	8	66.7%	64	36.6%
Other	0	0.0%	1	0.8%	1	0.6%	1	8.3%	2	1.1%
Totals	43		120		163		12		175	

Table 8 Anatomical site of infection by ward type. The total number of patients is 163 because the Table does not include data about 12 patients who received prophylactic antibiotics.

Site	Acute	%	ARLS	%	Total	%
Gastrointestinal	12	18.5%	15	15.3%	27	16.6%
LRTI other	1	1.5%	7	7.1%	8	4.9%
LRTI pneumonia	19	29.2%	11	11.2%	30	18.4%
Sepsis, site unknown	5	7.7%	6	6.1%	11	6.7%
Skin Soft Tissue Bone and Joint	4	6.2%	10	10.2%	14	8.6%
Unknown	3	4.6%	13	13.3%	16	9.8%
Urinary	21	32.3%	35	35.7%	56	34.4%
Other	0	0.0%	1	1.0%	1	0.6%
Totals	65		98		163	

Table 9: Use of Royal Free Policy Restricted Drugs (cephalosporins, ciprofloxacin, clarithromycin and co-amoxiclav) by Royal Free Policy Diagnosis (cellulitis, lower respiratory tract infection or sepsis or urinary tract infection) for Acute Wards, Assessment, Rehabilitation and Long Stay (A&R&LS) Wards and All Wards.

Acute Wards		Royal Free Policy Restricted Drugs		
		Yes	No	Total
Royal Free Policy Diagnosis	Yes	31	17	48
	No	1	17	18
	Total	32	34	66
A&R&LS Wards		Royal Free Policy Restricted Drugs		
		Yes	No	Total
Royal Free Policy Diagnosis	Yes	38	29	67
	No	12	30	42
	Total	50	59	109
All Wards		Royal Free Policy Restricted Drugs		
		Yes	No	Total
Royal Free Policy Diagnosis	Yes	69	46	115
	No	13	47	60
	Total	82	93	175