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Health protection – providing information and advice and taking action to protect people from communicable disease and environmental hazards

Primary, community and integrated care – strengthening its public health impact through policy, commissioning, planning and service delivery

- providing a network of microbiology services which support the diagnosis and management of infectious diseases

Safeguarding – providing expertise and strategic advice to help safeguard children and vulnerable adults

Screening – providing screening programmes which assist the early detection, prevention and treatment of disease

Health intelligence – providing public health data analysis, evidence finding and knowledge management

NHS quality improvement and patient safety – providing the NHS with information, advice and support to improve patient outcomes

- influencing policy, supporting research and contributing to international health development

Health improvement – working across agencies and providing population services to improve health and reduce health inequalities

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Section 1: Introduction

Background

Welsh Antimicrobial Resistance Programme Surveillance Unit
This report from the Welsh Antimicrobial Resistance Programme Surveillance Unit regarding antimicrobial usage in secondary care is aimed at providing an overview of hospital antimicrobial usage in Wales. The report has had to be selective in what is presented, and concentrates on the major acute hospitals and district general hospitals in Wales.

Surveillance of Antimicrobial Usage in Secondary Care
While the use of antimicrobials has revolutionised our ability to treat infections it is associated inevitably with the risk of development and spread of antimicrobial resistance leading to infections that are increasingly difficult to treat, and antimicrobial-associated adverse events, importantly Clostridium difficile-associated disease (CDAD).

It has been estimated that 20-50% of antimicrobial use, both in the Community and in Hospitals, is “inappropriate”. This means that patients and society may be exposed to a significant unnecessary risk of resistant infections and CDAD. In addition there is a financial cost, not only in terms of unnecessary antimicrobial use, but also the additional cost of treating resistant infections and CDAD. A key step in improvement of antimicrobial use is the surveillance and assessment of current antimicrobial usage. This can be achieved using a number of complementary methods including:

- Gross surveillance of antimicrobial usage at hospital, specialty or ward/unit level: This can provide comparative information regarding the choice and quantity of agents used, but does not address the indications or appropriateness of antimicrobial use. This current report provides such data at the hospital level and can be used to stimulate more detailed analysis.

- Point Prevalence Survey (PPS): In this type of survey, the prescription chart of every patient in a ward or hospital on a set day is checked to see if an antibiotic has been prescribed, and the reasons for the prescription are recorded. This local information about which antibiotics are used and why can be used to target interventions. The Welsh Antimicrobial Resistance Programme is engaged with ECDC, an EU-funded collaboration that, among other projects, supports hospitals in performing comparative PPSs across Europe.

- Local unit/ward audits: Audit can be used to explore in detail the indications, dose, duration etc. of antimicrobial prescriptions in order to identify areas for improvement.

It is hoped that access to this data will support:

- Audit patterns of antimicrobial usage
- Audit of compliance to guidelines and formularies
- Monitoring the outcomes of interventions.
- Educational programs
Section 2: Key points of interest

Antimicrobial Usage in Secondary Care
Antimicrobial usage varies between hospitals in Wales with significant changes over the last 10 years in response to the problem of *C. difficile*.

- Total antibacterial use
  - In 2015, seven of the sixteen individual hospitals reported showed a decrease in total antimicrobial usage, seven showed an increase in usage, two showed no significant change in usage compared to the previous year. Overall, there was no significant change in usage.
  - In 2015, an overall decrease in the usage of co-amoxiclav was established, due to significant decreases in usage at several sites.
  - The downward trend in usage in the cephalosporin group and in the fluoroquinolones levelled off in 2011, and usage remains relatively unchanged for both.
  - Carbapenem usage (e.g. meropenem) showed a steady upward trend.
  - Piperacillin/tazobactam usage showed a steady upward trend.

- In terms of total antimicrobial use in secondary care across Wales in 2015
  - The commonest antibacterial type was beta-lactam/beta-lactamase inhibitor combinations (co-amoxiclav and piperacillin/tazobactam) which represented 22% of use, followed by broad-spectrum penicillins (e.g. amoxicillin) 12%, and beta-lactamase resistant penicillins (fluoxacillin) and macrolides (e.g. clarithromycin) both 10%.
  - Cephalosporins and fluoroquinolones (e.g. ciprofloxacin) which have been implicated as causes of *C. difficile* infection both represent 4.5% of total antibiotic use respectively (9% in total).

- There was significant inter-hospital variability in the average antimicrobial usage per quarter in 2015; the lowest use was recorded at Princess of Wales hospital (637 DDDs/1000 BD PQ) and highest use at Royal Glamorgan hospital (1414 DDDs/1000BD PQ) when using bed days as a denominator.

- If admissions were used as a denominator there was less inter-hospital variability with the lowest usage at Princess of Wales (3287 DDDs/1000 AD) and the highest use at University Hospital Llandough (7587 DDD/1000 AD).

- In 2015, there were significant changes in prescribing practices in the hospitals in Cardiff and Wales University Health Board and Cwm Taf University Health Board.

- There was significant inter-hospital variability in the types of antimicrobials used due to local prescribing policies and case mix. For example see Table 1:

<table>
<thead>
<tr>
<th></th>
<th>Broad Spectrum Penicillins (e.g. amoxicillin)</th>
<th>Beta-lactam/beta-lactamase combinations (e.g. co-amoxiclav)</th>
<th>Fluoroquinolones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ysbyty Glan Clwyd</td>
<td>16.8%</td>
<td>14.1%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Withybush Hospital</td>
<td>4.7%</td>
<td>33.7%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

Table 1: Inter-hospital variability in antimicrobial usage

3
**Section 3: Methods**

**Table 2: Codes for hospital and data**

<table>
<thead>
<tr>
<th>Health Board</th>
<th>Hospital</th>
<th>Hospital Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abertawe Bro Morgannwg UHB</td>
<td>Princess of Wales</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Morriston</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>Singleton</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>Neath Port Talbot</td>
<td>T</td>
</tr>
<tr>
<td>Aneurin Bevan HB</td>
<td>Royal Gwent</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Nevill Hall</td>
<td>M</td>
</tr>
<tr>
<td>Betsi Cadwaladr UHB</td>
<td>Wrexham Maelor</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>Ysbyty Gwynedd</td>
<td>K</td>
</tr>
<tr>
<td></td>
<td>Ysbyty Glan Clwyd</td>
<td>L</td>
</tr>
<tr>
<td>Cardiff and Vale UHB</td>
<td>University Hospital Wales</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>University Hospital Llandough</td>
<td>P</td>
</tr>
<tr>
<td>Cwm Taf HB</td>
<td>Royal Glamorgan</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Prince Charles</td>
<td>N</td>
</tr>
<tr>
<td>Hywel Dda HB</td>
<td>Bronlais</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Withybush</td>
<td>G</td>
</tr>
<tr>
<td></td>
<td>Glangwili</td>
<td>J</td>
</tr>
<tr>
<td></td>
<td>Prince Philip</td>
<td>R</td>
</tr>
<tr>
<td>All-Wales</td>
<td>All-Wales</td>
<td>Z</td>
</tr>
</tbody>
</table>

**Pharmacy data**

**Data sources**
Antimicrobial ward stock data was extracted from the MEDUSA database.

The ward stock data held on pharmacy systems is not primarily intended for analysis of comparative usage and thus there is significant data processing required to standardize the data. Thus the data presented in this report has been coded and measured using the ATC/DDD system. The measure for antimicrobial usage is Defined Daily Doses per 1000 Bed Days (DDD/1000 BD). Bed days have been calculated using in-patient activity (average daily occupied beds) downloaded from Health Solutions Wales Information and Statistics website: e-Quest.

"DDD" stands for Defined Daily Dose. DDDs provide a standard measure of drug usage that can be used for international drug utilisation studies. They are administered by the WHO Collaborating Centre for Drug Statistics Methodology at the Norwegian Institute of Public Health which is linked directly to WHO Headquarters in Geneva.
[http://www.whocc.no/atcddd/](http://www.whocc.no/atcddd/)

**Note:** Due to previous technical difficulties with the Morriston pharmacy system, the data for 2005-2012 did not include RETURNS. From 2013 onwards RETURNS are included in the data set and any apparent reductions in usage in Morriston in 2013 may simply be due to the inclusion of RETURNS – interpret data with caution.
Antimicrobial Groups

Data is presented for the following antimicrobials/antimicrobial groups (ATC code):

- Tetracyclines e.g. oxytetracycline (J01AA)
- Amphenicols e.g. chloramphenicol (J01BA)
- Broad spectrum penicillins (BSP) e.g. amoxicillin (J01CA)
- Beta-lactamase sensitive penicillins e.g. penicillin V (J01CE)
- Beta-lactamase resistant penicillins e.g. flucloxacillin (J01CF)
- Beta-lactam/beta-lactamase inhibitor combinations (J01CR)
  - Co-amoxiclav (J01CR02)
  - Piperacillin/tazobactam (J01CR05)
- All cephalosporins (J01D)
- First generation cephalosporins e.g. cefalexin (J01DB)
- Second generation cephalosporins e.g. cefuroxime (J01DC)
- Third generation cephalosporins e.g. cefotaxime (J01DD)
- Monobactams e.g. aztreonam (J01DF)
- Carbapenems e.g. imipenem (J01DH)
- Trimethoprim & sulphonamides (J01E)
- Macrolides e.g. erythromycin (J01FA)
- Lincosamides & streptogramins e.g. clindamycin (J01F)
- Streptomycin (J01GA)
- Aminoglycosides e.g. gentamicin (J01GB)
- Fluoroquinolones e.g. ciprofloxacin (J01MA)
- Glycopeptides e.g. vancomycin (J01XA)
- Polymyxins e.g. colistin (J01XB)
- Fusidic Acid (J01XC)
- Imidazole derivatives e.g. metronidazole (J01XD)
- Nitrofuran derivatives e.g. nitrofurantoin (J01XE)
- Other antibacterials e.g. linezolid (J01XX)
- Rifampicin (J04AB)

Data presented

Pharmacy systems are primarily designed to support stock control and distribution and may be differently configured in different Trusts/Hospitals. In order to increase comparability, the antimicrobial usage data presented in this report only includes the following "issue types" from pharmacy:

- In-patient Scripts (IP Scripts)
- Patients’ Own Medications (POMs) or One Stop Medications
- Returns
- To Take Away (TTA)/Discharge Scripts
- Ward Requisitions

The main objective of this report is to show trends in antimicrobial usage within the hospital. Thus the dataset does not include the issue types A&E scripts, Clinics, Day cases, Day hospital, OP scripts and Sales usage. We are unable to resolve returns against their original issue type, and only present IP scripts, POMs, returns, TTAs and ward requisitions. Therefore, data presented may be an under representation of true hospital usage if returns were for OP scripts etc. Conversely, the data may represent an over estimate of true in hospital use depending on the amount of POMs and TTA medication taken out of hospital.
Note 1: Only data for oral and parenteral antimicrobial usage are included in this report; it DOES NOT include topical, inhaled, rectal or genital preparation usage.

Note 2: The data set for Bronglas hospital is incomplete, and does not include data for the clinical decisions unit (CDU). CDU issues are dispensed to the A&E issue point and cannot be identified and separated from A&E issues. Therefore, the data presented in this report is an UNDERESTIMATE of usage at Bronglas hospital. The data for all other clinical decisions units are included in the relevant hospital data sets.

Data Interpretation

In interpreting the data presented in this report it is important to appreciate the ways in which the data is collated and the factors that may drive variability in antimicrobial usage between hospitals. Important issues that should be considered include:

- Data applicability. As noted above, the data is drawn from Pharmacy computer systems that are designed primarily for stock control, and which are configured slightly differently in different units. These differences may mean that some antimicrobials that are used out-of-hospital are included in the data.
- The usage of antimicrobials is standardised against a denominator of patient activity (i.e. 1000 bed days) but may also be influenced by patient case-mix in different hospitals. Thus a hospital which treats significant numbers of immunocompromised patients might be expected to use comparatively larger amounts of broad-spectrum antimicrobials.
- The usage of antimicrobials should normally reflect the antimicrobial policies of each unit. For example the usage of piperacillin/tazobactam rather than an alternative broad spectrum agent may be a reflection of the hospital policy for the treatment of patients presenting with neutropenic sepsis.
- The data presented can be used to identify changes in usage and monitor the effect of interventions.
- When interpreting graphs it is important to note that the y-axis scales vary between graphs and care should be used in interpretation.
Section 4: Antibacterial Usage

This section presents hospital antimicrobial stock data, and dispensed prescription data for primary care. It is important to understand the differences in the two data sets in order to interpret the data: Hospital ward stock data held on pharmacy systems is not primarily intended for analysis of comparative usage and thus there is significant data processing required to standardize the data. The data presented in this report has been coded and measured using the ATC/DDD system. The measure for hospital antimicrobial usage is Defined Daily Doses per 1000 Bed Days (DDD/1000 BD). It is important to remember that changes in DDDs may not only reflect changes in the number of patients receiving antibacterials, but also variance in dosage and duration.
Section 4.1: Antibacterial Usage in Secondary care

All Wales Antibacterial Usage for Secondary Care in 2015

Figure 1: Comparisons in Antibacterial Usage 2012 - 2015 for All-Wales

Figure 1 shows the pattern of antibacterial usage for All-Wales acute hospitals for 2012 (blue bars), 2013 (green bars), 2014 (purple bars) and 2015 (grey bars).

In 2015, there was an increase in prescribing of a number of antibacterial groups, including broad spectrum pencillins (J01CA), tetracyclines (J01AA), trimethoprim group (J01E), glycopeptides (J01XA), beta-lactamase sensitive pencillins (J01CE), and aminoglycosides (J01GB); and a decrease in beta-lactam/beta-lactamase inhibitor combinations (J01CR), fluoroquinolones, (J01MA) and second generation cephalosporins (J01DC).
Figure 2: Top 10 Antibacterial Usage for 2015

Figure 2 shows the Top 10 antibacterial group usage for 2015: beta-lactam/beta-lactamase inhibitor combinations were the most used antibacterials, accounting for 22% of total antibacterial usage. Fluoroquinolones (J01MA) and cephalosporins (J01DB, J01DC & J01DD) both accounted for 4% of usage, and carbapenems (J01DH) – 3%.

Figure 3: Trends in Specific Antibacterial Group Usage 2006–2015 (Restricted)
Figure 3 shows All-Wales trends in usage from 2006-2015 for antibacterials that have restricted usage in some/all hospitals: beta-lactam/beta-lactamase inhibitor combinations: co-amoxiclav (J01CR02), and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) decreased in 2014, levelling off in 2015.
- Piperacillin/tazobactam usage (J01CR05) shows an upward trend across time.
- The downward trend cephalosporin usage (J01D) levelled off in 2011 and remains relatively unchanged.
- Fluoroquinolone usage (J01MA) shows a general downward trend across time.
- Carbapenem usage (J01DH) e.g. meropenem, shows an upward trend.
- Total antibacterial usage across Wales shows no significant change over time, except for seasonal variation (see Figure 4).

Figure 4: Trends in Total Antibacterial Usage 2006-2015
Figure 5: Trends in Antibacterial Group Usage 2006-2015 (Respiratory)

Figure 5 shows the trends in usage for antibacterials that can be used to treat respiratory tract infections: co-amoxiclav (J01CR02), broad spectrum penicillins (J01CA), fluoroquinolones (J01MA), macrolides (J01FA), and tetracyclines (J01AA):

- Co-amoxiclav usage (J01CR02) decreased in 2014, levelling off in 2015.
- Broad spectrum penicillin and macrolide usage (J01CA & J01FA) e.g. amoxicillin and clarithromycin, show marked winter peaks.
- Tetracycline usage (J01AA) e.g. doxycycline, shows an upward trend, with winter peaks suggesting an increased use for respiratory infections.
- Fluoroquinolones usage (J01MA) e.g. levofloxacin shows a general downward trend across time.

Figure 6: Trends in Antibacterial Group Usage 2006-2015 (Urinary)
Figure 6 shows the trends in usage for antibacterials that can be used to treat urinary tract infections: co-amoxiclav (J01CR02), first generation cephalosporins (J01DB), fluoroquinolones (J01MA), nitrofurans (J01XE), and trimethoprim and sulphonamide combinations (J01E):

- Co-amoxiclav usage (J01CR02) decreased in 2014, levelling off in 2015.
- First generation cephalosporin usage (J01DB) e.g. cefalexin decreased between 2008/2009 but has levelled off since.
- Nitrofurantoin usage (J01XE) and trimethoprim and co-trimoxazole usage (J01E) shows an upward trend.
- Fluoroquinolones usage (J01MA) e.g. ciprofloxacin shows a general downward trend.

Figure 7: Trends in Antibacterial Group Usage 2006-2015 (Surgery)

Figure 7 shows the trends in usage for antibacterials that can be used for surgical prophylaxis and treatment of intra-abdominal infection: co-amoxiclav (J01CR02), aminoglycosides (J01GB), second generation cephalosporins (J01DC), and imidazoles (J01XD):

- Co-amoxiclav usage (J01CR02) decreased in 2014, levelling off in 2015.
- Aminoglycoside usage (J01GB) e.g. gentamicin shows an upward trend.
- Imidazole usage (J01XD) e.g. metronidazole shows no change.
- Second generation cephalosporin usage (J01DC) e.g. cefuroxime shows a general downward trend.
Figure 8: Trends in Antibacterial Group Usage 2006-2015 (Skin & Other)

Figure 8 shows the trends in usage for antibacterials that can be used for skin and soft tissue infection, and other agents: beta-lactamase sensitive penicillins (J01CE), beta-lactamase resistant penicillins (J01CF), glycopeptides (J01XA), lincosamides (J01F) and piperacillin/tazobactam (J01CR05):

- Beta-lactamase resistant penicillin usage (J01CF) e.g. flucloxacillin shows an upward trend, with marked summer peaks in usage.
- Beta-lactamase sensitive penicillin usage (J01CE) e.g. benzylpenicillin has levelled off and shows marked spring peaks in usage.
- Glycopeptide usage (J01XA) e.g. vancomycin shows an upward trend. Data from the point prevalence survey suggests that this is largely due to an increase in oral vancomycin.
- Lincosamide usage (J01FF) e.g. clindamycin shows an upward trend.
- Piperacillin/tazobactam usage (J01CR05) shows an upward trend across time.

Note: Please note the difference in the y-axis scale which is smaller and finishes at 150 DDD/1000 BD per quarter.
Comparisons between hospitals (Overall Antibacterial Use)

Figure 9: Total antibacterial usage by hospital – DDD/1000 Bed days

The average total antibacterial usage in 2015 for the acute hospitals in Wales is shown in Figures 9 and 10. Figure 9 shows usage in defined daily doses per 1000 bed days, and a six-fold variation in antibacterial usage between hospitals at either end of the scale; The acute hospital at the low end of the scale used 637 DDD/1000 BD (Princess of Wales), compared to 1414 DDD/1000 BD for the hospital at the high end of the scale (Royal Glamorgan). Note: Neath Port Talbot is no longer considered an acute hospital, and will not be included in this or future reports.

Figure 10 shows usage in defined daily doses per 1000 admissions, some of the hospitals that appear at the top end of the table have a higher average length of stay and therefore fewer admissions e.g. University Hospital Llandough (P) with the cystic fibrosis unit, and elective orthopaedic surgery unit (CAVOC) have an average length of stay of 7.4 days compared with the acute hospitals of average of 5.7 days.

Figure 10: Total antibacterial usage by hospital – DDD/1000 Admissions
Figure 11: Number of different antibacterials dispensed by each hospital

Figure 11 shows the number of different antibacterial agents dispensed as IP scripts, POMs, returns, TTA or ward requisitions in 2015 varied between hospitals from 37 to 55. The biggest number was used by the University Hospital of Wales (F), and the smallest number by Withybush hospital (G).

Figure 12: Proportion of total oral antibacterial usage by hospital

Figure 12 shows the proportion of total oral antibacterial usage by hospital in 2015, which varied between 56% and 71%. The hospital with the lowest proportion of oral antibacterial usage was Princess of Wales hospital (B) and the one with the highest proportion of oral usage was Ysbyty Glan Clwyd (L).
Comparisons between hospitals (Specific Antibacterial Use)

Figure 13: Tetracycline (J01AA) usage by hospital
The difference in average tetracycline (J01AA) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 13. There was >eight-fold variation in J01AA usage between hospitals at either end of the scale; the hospital at the low end of the scale used 29 DDD/1000 BD of J01AA compared to 256 DDD/1000 BD for the hospital at the high end of the scale. J01AA as a proportion of total usage varied between 4% at Bronglais (A) and Withybush (G) to 18% at Royal Glamorgan (C).

Figure 14: Broad spectrum penicillin (J01CA) usage by hospital
The difference in average broad spectrum penicillin (J01CA) usage per quarter between the acute hospitals in Wales for 2015, and J01CA usage as a proportion of total antibacterial usage is shown in Figure 14. There was seven-fold variation in J01CA usage between hospitals; the hospital at the low end of the scale used 31 DDD/1000 BD compared to 220 DDD/1000 BD for the hospital at the high end of the scale. J01CA as a proportion of total usage varied between 4% at Bronglais (A), to 17% at Ysbyty Glan Clwyd (L).
Figure 15: Co-amoxiclav (J01CR02) usage

The difference in average co-amoxiclav (J01CR02) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 15. There was fifteen-fold variation in J01CR02 usage between hospitals at either end of the scale; the hospital at the low end used 21 DDD/1000 BD of J01CR02 compared to 324 DDD/1000 BD for the hospital at the high end of the scale. J01CR02 as a proportion of total usage varied between 2% at University Hospital Llandough (P) to 27% at Bronlais (A).

Figure 16: Piperacillin/tazobactam (J01CR05)

The difference in average piperacillin/tazobactam (J01CR05) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 16. There was three-fold variation in J01CR05 usage between hospitals at either end of the scale; the hospital at the low end used 32 DDD/1000 BD of J01CR05 compared to 95 DDD/1000 BD for the hospital at the high end of the scale. J01CR05 as a proportion of total usage varied between 2.3% at Royal Glamorgan hospital (C) to 8.8% at Withybush (G).
Figure 17: Cephalosporin (J01D) usage by hospital

The difference in average cephalosporin (J01D) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 17. There was a three-fold variation in J01D usage between hospitals at either end of the scale; the hospital at the low end used 16 DDD/1000 BD of J01D compared to 86 DDD/1000 BD for the hospital at the high end. J01D as a proportion of total usage varied between 2.4% at Nevill Hall (M) to 9.0% at Glangwili (J).

Figure 18: Fluoroquinolone (J01MA) usage by hospital

The difference in average fluoroquinolone (J01MA) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 18. There was a wide variation in J01MA usage between hospitals; the hospital at the low end of the scale used 40 DDD/1000 BD compared to 77 DDD/1000 BD for the hospital at the high end of the scale. J01MA as a proportion of total usage varied between 1.4% at Singleton (S) to 6.4% at Ysbyty Glan Clwyd (L).
Figure 19: Carbapenem (J01DH) usage by hospital
The difference in average carbapenem (J01DH) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 19. There was marked variation in J01DH usage between hospitals; the hospital at the low end of the scale used 4 DDD/1000 BD of J01DH compared to 67 DDD/1000 BD for the hospital at the high end of the scale. J01DH as a proportion of total usage varied between 0.4% at Nevill Hall hospital (M) to 6.7% at University Hospital Llandough (P).

Figure 20: Carbapenem (J01DH) usage by entity (%)
The proportion of carbapenem (J01DH) usage at entity level is shown in Figure 20. The proportion of total J01DH usage that was meropenem varied between hospitals, from 71% at Royal Gwent (D), and 90% at Nevill Hall hospital to >98% at all other hospitals.
Figure 21: Glycopeptide (J01XA) usage by hospital
The difference in average glycopeptide (J01XA) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 21. There was a wide variation in J01XA usage between hospitals; the hospital at the low end of the scale used 10 DDD/1000 BD of J01XA compared to 115 DDD/1000 BD for the hospital at the high end. J01XA as a proportion of total usage varied between 1.1% at Withybush (G) to 9.4% at Prince Charles hospital (N).

Figure 22: Glycopeptide (J01XA) usage by entity (%)
The proportion of glycopeptide (J01XA) usage at entity level is shown in Figure 22. The proportion of total J01DH usage that was vancomycin varied between hospitals, from 2% at Royal Glamorgan (C) to 81% at Prince Philip hospital (R).
Figure 23: Aminoglycoside (J01GB) usage by hospital
The difference in average aminoglycoside (J01GB) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 23. There was wide variation in J01GB usage between hospitals; the hospital at the low end of the scale used 5 DDD/1000 BD of J01GB compared to 61 DDD/1000 BD for the hospital at the high end of the scale. J01GB as a proportion of total usage varied between 0.7% in Singleton hospital (S) to 6.1% at University Hospital Llandough (P).

Figure 24: Macrolide (J01FA) usage by hospital
The difference in average macrolide (J01FA) usage per quarter between the acute hospitals in Wales for 2015, and as a proportion of total antibacterial usage is shown in Figure 24. There was a five-fold variation in J01FA usage between hospitals at either end of the scale; the hospital at the low end of the scale used 53 DDD/1000 BD compared to 192 DDD/1000 BD for the hospital at the high end of the scale. J01FA as a proportion of total usage varied between 6% at Morriston (E) to 20% at Prince Philip hospital (R).
Figure 25: Morriston Hospital - Antibacterial Usage for 2012 to 2015

Figure 25 shows the pattern of antibacterial usage for Morriston hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars) and 2015 (grey bars). In 2015, there was an increase in prescribing of beta-lactamase resistant pencillins (J01CF), broad spectrum pencillins (J01CA), fluoroquinolones (J01MA), rifampicin (J04AB), fusidic acid (J01XC) and lincosamides (J01F); and a decrease in beta-lactam/beta-lactamase inhibitor combinations (J01CR), macrolides (J01FA), imidazoles (J01XD), tetracyclines (J01AA), glycopeptides (J01XA), carbapenems (J01DH), all cephalosporins (J01DB, J01DC, J01DD), beta-lactamase sensitive pencillins (J01CE), and aminoglycosides (J01GB).
Figure 26: Top 10 Antibacterial Usage for 2014

Figure 26 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials accounting for 30% of total antibacterial usage. Fluoroquinolones (J01MA) accounted for 5% of use, cephalosporins (J01DB, J01DC & J01DD) 5% of usage, and carbapenems (J01DH) a further 4%.

Figure 27: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 27 shows trends in specific antibacterial usage in Morriston hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) decreased in 2015.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend.
- The downward trend cephalosporin usage (J01D) levelled off in 2012.
- Fluoroquinolone usage (J01MA) increased slightly in 2015.
- Carbapenem usage (J01DH) shows an upward trend across time.
- Total antibacterial usage in Morriston levelled off in 2011 and shows little change other than winter prescribing peaks (see Figure 28).

![Graph showing antibacterial usage trends](image)

**Figure 28: Trends in Total Antibacterial Usage 2006-2015 – Morriston Hospital**
Figure 29: Princess of Wales Hospital - Antibacterial Usage for 2012 to 2015

Figure 29 shows the pattern of antibacterial usage for Princess of Wales hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars) and 2015 (grey bars).

In 2015, there was a small increase in prescribing of beta-lactam/beta-lactamase inhibitor combinations (J01CR), beta-lactam sensitive penicillins (J01CE), trimethoprim group (J01E), first generation cephalosporins (J01DB), carbapenems (J01DH), and fluoroquinolones (J01MA); and a decrease in second generation cephalosporins (J01DC) and glycopeptides (J01XA).
**Figure 30: Top 10 Antibacterial Usage for 2015**

*Figure 30* shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for 30% of total antibacterial usage (30%). Cephalosporins (J01DB, J01DC & J01DD) accounted for a further 7% of usage, carbapenems (J01DH) - 2%, and fluoroquinolones (J01MA) - 2%.

**Figure 31: Trends in Specific Antibacterial Group Usage 2006-2015**


**Figure 31** shows trends in specific antibacterial usage in Princess of Wales hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) levelled off in 2014/15.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend, levelling off in 2015.
- Cephalosporin usage (J01D) shows a general downward trend.
- Fluoroquinolone usage (J01MA) shows a small increase in 2015.
- Carbapenem usage (J01DH) shows a small increase in 2015.
- Total antibacterial usage shows a marked downward trend over time with winter prescribing peaks (see **Figure 32**).

![Figure 32: Trends in Total Antibacterial Usage 2006-2015](image)
Figure 33: Singleton Hospital - Antibacterial Usage for 2015

Figure 33 shows the pattern of antibacterial usage for Singleton hospital for 2013 (green bars), 2014 (purple bars) and 2015 (grey bars) there is no comparative data for 2012. In 2015, there was an increase in prescribing of aminoglycosides (J01GB), tetracyclines (J01AA), glycopeptides (J01XA), and nitrofurans (J01XE), but for most antibacterial groups prescribing decreased compared to 2014.
Figure 34: Top 10 Antibacterial Usage for 2015

Figure 34 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for 29% of total antibacterial usage. Cephalosporins (J01DB, J01DC & J01DD) accounted for a further 9% of usage, carbapenems (J01DH) - 6%, and fluoroquinolones (J01MA) - 1%.

Figure 35: Trends in Specific Antibacterial Group Usage 2013-2015
Figure 35 shows trends in specific antibacterial usage in Singleton hospital from 2013-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows no significant change across time.
- Piperacillin/tazobactam usage (J01CR05) shows no significant change across time.
- Cephalosporin usage (J01D) and fluoroquinolone usage (J01MA) show a general downward trend.
- Carbapenem usage (J01DH) increased in 2015.
- Total antibacterial usage shows a general downward trend over time with winter prescribing peaks (see Figure 36).

Figure 36: Trends in Total Antibacterial Usage 20013-2015
Figure 37: Nevill Hall Hospital - Antibacterial Usage for 2012 to 2015

Figure 37 shows the pattern of antibacterial usage for Nevill Hall hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was an increase in prescribing of aminoglycosides (J01GB), tetracyclines (J01AA), glycopeptides (J01XA) and nitrofurans (J01XE), but for most antibacterial groups prescribing decreased compared to 2014.
Figure 38: Top 10 Antibacterial Usage for 2015

Figure 38 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations were the most used antibacterials, accounting for over a quarter of total antibacterial usage (26%). Cephalosporins (J01DB, J01DC & J01DD) accounted for a further 3% of usage, Fluoroquinolones (J01MA) - 2%, and carbapenems (J01DH) - 2%.

Figure 39: Trends in Specific Antibacterial Group Usage 2006-2015
**Figure 39** shows trends in specific antibacterial usage in Nevill Hall hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows a marked downward trend in 2013, levelling off in 2014/15.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend.
- Cephalosporin usage (J01D) and fluoroquinolone usage (J01MA) shows a general downward trend.
- Carbapenem usage (J01DH) shows a downward trend from 2013 onwards.
- Total antibacterial usage appears to have levelled off in the later quarters of 2015 (see **Figure 40**).

**Figure 40: Trends in Total Antibacterial Usage 2006-2015**
Figure 41: Royal Gwent Hospital - Antibacterial Usage for 2012 to 2015

Figure 41 shows the pattern of antibacterial usage for Royal Gwent hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was an increase in prescribing of a number of antibacterial groups, including beta-lactam/beta-lactamase inhibitor combinations (J01CR), beta-lactamase resistance penicillins (J01CF), tetracyclines (J01AA), fluoroquinolones (J01MA), trimethoprim group (J01E), aminoglycosides (J01GB), glycopeptides (J01XA), carbapenems (J01DH), nitrofurans (J01XE) and fusidic acid (J01XC); and a decrease in broad spectrum penicillins (J01CA), all cephalosporins (J01DB, J01DC, J01DD) adn rifampicin (J04AB).
Figure 42: Top 10 Antibacterial Usage for 2015

Figure 42 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for 27% of total antibacterial usage. Fluoroquinolones (J01MA) accounted for a further 5% of usage, carbapenems (J01DH) - 3% and cephalosporins (J01DB, J01DC & J01DD) - 3%.

Figure 43: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 43 shows trends in specific antibacterial usage in Nevill Hall hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows little change from 2013 onwards.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend.
- Cephalosporin usage (J01D) decreased in 2015.
- Fluoroquinolone usage (J01MA) increased in 2015.
- Carbapenem usage (J01DH) shows an upward trend.
- Total antibacterial usage shows some seasonal variation with an increase in usage in 2015 (see Figure 44).

Figure 44: Trends in Total Antibacterial Usage 2006-2015
Figure 45: Wrexham Maelor Hospital - Antibacterial Usage for 2012 to 2015

Figure 45 shows the pattern of antibacterial usage for Wrexham Maelor hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was an increase in prescribing of a number of antibacterial groups, including beta-lactam/beta-lactamase inhibitor combinations (J01CR), broad spectrum penicillins (J01CA), macrolides (J01FA), tetracyclines (J01AA), beta-lactamase resistant penicillins (J01CF), glycopeptides (J01XA), fluoroquinolones (J01MA), imidazoles (J01XD), trimethoprim group (J01E), lincosamides (J01F0), nitrofurans (J01XE), rifampicin (J04AB), and beta-lactamase sensitive penicillins (J01CE) compared with 2014.
Figure 46: Top 10 Antibacterial Usage for 2015

Figure 46 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations were the most used antibacterials, accounting for 26% of total antibacterial usage. Fluoroquinolones (J01MA) accounted for a further 6% of usage, cephalosporins (J01DB, J01DC & J01DD) - 4%, and carbapenems (J01DH) - 4%.

Figure 47: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 47 shows trends in specific antibacterial usage in Wrexham Maelor hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) decreased in 2014/15.
- Piperacillin/tazobactam (J01CR05) shows an upward trend, levelling off in 2015.
- Fluoroquinolone usage (J01MA) increased in 2015.
- Cephalosporin usage (J01D) shows variation in usage over time with no obvious trend.
- Carbapenem usage (J01DH) levelled off in 2015.
- Total antibacterial usage has increased over time, and shows some winter prescribing peaks (see Figure 48).

![Graph showing trends in antibacterial usage 2006-2015]

Figure 48: Trends in Total Antibacterial Usage 2006-2015
Figure 49: Ysbyty Glan Clwyd - Antibacterial Usage for 2012 to 2015

Figure 49 shows the pattern of antibacterial usage for Ysbyty Glan Clwyd for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was an increase in prescribing for a number of antibacterial groups including beta-lactam/beta-lactamase inhibitor combinations (J01CR), macrolides (J01FA), beta-lactamase resistant penicillins (J01CF), tetracyclines (J01AA), glycopeptides (J01XA), rifampicin (J04AB), and aminoglycosides (J01GB); and a decrease in broad spectrum penicillins (J01CA), imidazoles (J01XD), fluoroquinolones (J01MA), trimethoprim group (J01E), lincosamides (J01F), all cephalosporins (J01DB, J01DC, J01DD), and nitrofurans (J01XE).
Figure 50: Top 10 Antibacterial Usage for 2015

Figure 50 shows the Top 10 antibacterial group usage for 2015; broad spectrum penicillins (J01CA) were the most used antibacterials, accounting for 17% of total antibacterial usage. Beta-lactam/beta-lactamase inhibitor combinations (J01CR) accounted for a further 14% of usage, fluoroquinolones (J01MA) - 6% cephalosporins (J01DB, J01DC & J01DD) - 5%, and carbapenems (J01DH) - 2%.

Figure 51: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 51 shows trends in specific antibacterial usage in Ysbyty Glan Clwyd from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) has increased from 2013 onwards.
- Piperacillin/tazobactam (J01CR05) shows an upward trend across time.
- Cephalosporin usage (J01D) and fluoroquinolone usage (J01MA) show a general downward trend across time.
- Carbapenem usage (J01DH) shows an upward trend.
- Total antibacterial usage shows a general downward trend across time but with notable winter prescribing peaks (see Figure 52).

![Graph showing antibacterial usage trends from 2006 to 2015]

Figure 52: Trends in Total Antibacterial Usage 2006-2015
Figure 53: Ysbyty Gwynedd - Antibacterial Usage for 2012 to 2015

Figure 53 shows the pattern of antibacterial usage for Ysbyty Gwynedd for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was a marked decrease in prescribing of beta-lactam/beta-lactamase inhibitor combinations (J01CR), broad spectrum pencillins (J01CA), beta-lactamase resistant pencillins (J01CF), macrolides (J01FA), imidazoles (J01XD), fluoroquinolones (J01MA), trimethoprim group (J01E), carbapenems (J01DH), beta-lactamase sensitive pencillins (J01CE), second and third generation cephalosporins (J01DC & J01DD); and increases in prescribing of tetracycline (J01AA), glycopeptides (J01XA), lincosamides (J01F), rifampicin (J04AB), aminoglycosides (J01GB), and fusidic acid (J01XC).
Figure 54: Top 10 Antibacterial Usage for 2015

Figure 54 shows the Top 10 antibacterial group usage for 2015; broad spectrum penicillins (J01CA) were the most used antibacterials, accounting for 18% of total antibacterial usage (19%). Fluoroquinolones (J01MA) accounted for a further 5% of usage, cephalosporins (J01DB, J01DC & J01DD) - 5%, and carbapenems (J01DH) - 2%.

Figure 55: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 55 shows trends in specific antibacterial usage in Ysbyty Gwynedd from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows a general downward trend from 2011 onwards.
- Piperacillin/tazobactam (J01CR05) shows an upward trend across time.
- Cephalosporin usage (J01D) and fluoroquinolone usage (J01MA) show a general downward trend across time.
- Carbapenem usage (J01DH) levelled off in 2015.
- Total antibacterial usage shows a marked upward trend over time but with notably low usage in the latter quarters of 2015 (see Figure 56).

![Graph showing trends in antibacterial usage]

**Figure 56:** Trends in Total Antibacterial Usage 2006-2015
Figure 57: University Hospital Llandough Hospital - Antibacterial Usage for 2012 to 2015

Figure 57 shows the pattern of antibacterial usage for Llandough hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was an increase in prescribing broad spectrum penicillins (J01CA), trimethoprim & sulphonamides group (J01E), glycopeptides (J01X1A), rifampicin (J04AB), third generation cephalosporins (J01DD), and lincosamides (J01F); and a marked decrease in prescribing of beta-lactam/beta-lactamase inhibitor combinations (J01CR), fluoroquinolones (J01MA), polymyxins (J01XB), and second generation cephalosporins (J01DC).
Figure 58: Top 10 Antibacterial Usage for 2015

Figure 58 shows the Top 10 antibacterial group usage for 2015; broad spectrum penicillins were the most used antibacterials, accounting for 14% of total antibacterial usage. Carbapenems accounted for a further 7% of usage, beta-lactam/beta-lactamase inhibitor combinations – 5%, fluoroquinolones (J01MA) - 5%, and cephalosporins (J01DB, J01DC & J01DD) – 4%.

Figure 59: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 59 shows trends in specific antibacterial usage in University Hospital Llandough from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows a marked downward trend from 2014 onwards.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend, levelling off in 2015.
- Cephalosporin usage (J01D) and fluoroquinolone usage (J01MA) show a general downward trend across time.
- Carbapenem usage (J01DH) shows an upward trend.
- There was a small increase in total antibacterial usage in 2015 compared with 2014 (see Figure 60).

Figure 60: Trends in Total Antibacterial Usage 2006-2015
Figure 61 shows the pattern of antibacterial usage for University Hospital of Wales for 2012 (blue bars), 2013 (green bars), 2014 (purple bars) and 2015 (grey bars).

In 2015, there was an increase in prescribing of a number of antibacterial groups, including broad spectrum penicillins (J01CA), trimethoprim group (J01E), beta-lactamase resistant penicillins (J01CF), tetracyclines (J01AA), macrolides (J01FA), imidazoles (J01XD), fluoroquinolones (J01MA), aminoglycosides (J01GB), lincosamides (J01F), beta-lactamase sensitive penicillins (J01CE), rifampicin (J04AB), second and third generation cephalosporins (J01DC/J01DD), and nitrofurans (J01XE); and a decrease in beta-lactam/beta-lactamase inhibitor combinations (J01CR).
Figure 62 Top 10 Antibacterial Usage for 2015

Figure 62 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for 15% of total antibacterial usage (30%). Fluoroquinolones (J01MA) accounted for a further 5% of usage, carbapenems (J01DH) - 4%, and cephalosporins (J01DB, J01DC & J01DD) - 4%.

Figure 63: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 63 shows trends in specific antibacterial usage in University Hospital of Wales from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows a marked downward trend in 2014, levelling off in 2015.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend.
- Cephalosporin usage (J01D) levelled off in 2010 onwards, and shows no significant change.
- Carbapenem usage (J01DH) shows an upward trend.
- The downward trend in fluoroquinolone usage (J01MA) levelled off in 2010, and shows an upward trend from mid-2010 onwards.
- Total antibacterial usage increased in 2015 (see Figure 64).

![Graph showing trends in antibacterial usage 2006-2015]

Figure 64: Trends in Total Antibacterial Usage 2006-2015
**Prince Charles Hospital (Cwm Taf Health Board)**

![Graph showing antibacterial usage for 2012 to 2015](image)

**Figure 65: Prince Charles Hospital - Antibacterial Usage for 2012 to 2015**

Figure 65 shows the pattern of antibacterial usage for Prince Charles hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there were increases in prescribing of broad spectrum penicillins (J01CA), beta-lactamase resistant penicillins (J01CF), imidazoles (J01XD), tetracyclines (J01AA), glycopeptides (J01XA), trimethoprim group (J01E), beta-lactamase sensitive penicillins (J01CE), aminoglycosides (J01GB) and first generation cephalosporins (J01DB); and a decrease in prescribing of beta-lactam/beta-lactamase inhibitor combinations (J01CR), macrolides (J01FA), fluoroquinolones (J01MA), rifampicin (J04AB), carbapenems (J01DH), and second and third generation cephalosporins (J01DC & J01DD).
Figure 66: Top 10 Antibacterial Usage for 2015

Figure 66 shows the Top 10 antibacterial group usage for 2015; broad spectrum penicillins were the most used antibacterials, accounting for 16% of total antibacterial usage (31%). Beta-lactam/beta-lactamase inhibitor combinations (J01CR) accounted for a further 12% of usage, cephalosporins (J01DB, J01DC & J01DD) - 5%, fluoroquinolones (J01MA) - 4%, and carbapenems (J01DH) - 1%.

Figure 67: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 67 shows trends in specific antibacterial usage in Prince Charles hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows a marked downward trend in 2014, levelling off in 2015.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend, levelling off in 2014/15.
- Cephalosporin usage (J01D) usage increased in 2013 but has levelled off in 2014/15.
- Fluoroquinolone usage (J01MA) shows a general downward trend.
- Carbapenem usage (J01DH) decreased in 2015.
- Total antibacterial usage shows a general downward trend over time, which appears to have levelled off in 2014/15 (see Figure 68).

Figure 68: Trends in Total Antibacterial Usage 2006-2015
Figure 69: Royal Glamorgan Hospital - Antibacterial Usage for 2012 to 2015

Figure 69 shows the pattern of antibacterial usage for Royal Glamorgan Hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was an increase in prescribing of a number of antibacterial groups, including tetracyclines (J01AA), beta-lactamase resistant penicillins (J01CF), broad spectrum penicillins (J01CA), trimethoprim group (J01E), glycopeptides (J01XA), imidazoles (J01XD), beta-lactamase sensitive penicillins (J01CE), aminoglycosides (J01GB), first and third generation cephalosporins (J01DB & J01DD), and rifampicin (J04AB); and a decrease in prescribing of beta-lactam/beta-lactamase inhibitor combinations (J01CR), macrolides (J01FA), fluoroquinolones (J01MA), carbapenems (J01DH), second generation cephalosporins (J01DC), and fusidic acid (J01XC).
Figure 70: Top 10 Antibacterial Usage for 2015

Figure 70 shows the Top 10 antibacterial group usage for 2015; broad spectrum penicillins were the most used antibacterials, accounting for 18% of total antibacterial usage (31%). Beta-lactam/beta-lactamase inhibitor combinations (J01CR) accounted for a further 12% of usage, cephalosporins (J01DB, J01DC & J01DD) - 3%, fluoroquinolones (J01MA) - 3%, and carbapenems (J01DH) - 1%.

Figure 71: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 71 shows trends in specific antibacterial usage in Royal Glamorgan hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows a marked downward trend in 2014, levelling off in 2015.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend, levelling off in 2014/15.
- Cephalosporin usage (J01D) increased in 2014/15.
- Carbapenem usage (J01DH) decreased in 2015.
- Fluoroquinolone usage (J01MA) shows a general downward trend over time.
- **Note**: Please note the difference in the y-axis scale for Figure 70 which extends to 550 DDD/1000 BD per quarter.
- Total antibacterial usage in Royal Glamorgan shows a continuing upward trend from 2012 onwards; with marked winter prescribing peaks (see Figure 72).

![Graph showing antibacterial usage trends](image)

**Figure 72: Trends in Total Antibacterial Usage 2006-2015**
**Figure 73: Bronlais Hospital - Antibacterial Usage for 2012 to 2015**

Figure 73 shows the pattern of antibacterial usage for Bronlais hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015 there was a decrease in prescribing of a number of antibacterial groups, including macrolides (J01FA), imidazole derivatives (J01XD), trimethoprim group (J01E), fluoroquinolones (J01MA), carbapenems (J01DH), broad spectrum penicillins (J01CA), all cephalosporins (J01DB, J01DC, J01DD), and glycopeptides (J01XA); and there were increases in prescribing of beta-lactam/beta-lactamase inhibitor combinations (J01CR).
Figure 74: Top 10 Antibacterial Usage for 2015

Figure 74 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for a third of total antibacterial usage (33%). Cephalosporins (J01DB, J01DC, & J01DD) accounted for a further 6% of usage, fluoroquinolones (J01MA) - 4%, and carbapenems (J01DH) - 4%.

Figure 75: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 75 shows trends in specific antibacterial usage in Bronlais hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows a general upward trend.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend.
- Cephalosporin usage (J01D) shows a downward trend.
- Carbapenem usage (J01DH) decreased in 2015.
- Fluoroquinolone usage (J01MA) shows a downward trend, and a decrease in the seasonal winter peaks over time.
- Total antimicrobial usage shows a downward trend between 2012 and 2015 (see Figure 76).

Figure 76: Trends in Total Antibacterial Usage 2006-2015

Note: The data set for Bronlais hospital is incomplete, and does not include data for the clinical decisions unit (CDU). CDU issues are dispensed to the A&E issue point and cannot be identified and separated from A&E issues. Therefore, the data presented in this report is an UNDERESTIMATE of usage at Bronlais hospital. The data for all other clinical decisions units are included in the relevant hospital data sets.
Figure 77: Glangwili Hospital - Antibacterial Usage for 2012 to 2015

Figure 77 shows the pattern of antibacterial usage for Glangwili hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars) and 2015 (grey bars).

In 2015, there were increase in prescribing of a number of antibacterial groups, including beta-lactamase resistant penicillins (J01CF), imidazoles (J01XD), beta-lactamase sensitive penicillins (J01CE), all cephalosporin groups (J01DB, J01DC, J01DD), fusidic acid (J01XC), and rifampicin (J04AB); and there was decrease beta-lactam/beta-lactamase inhibitor combinations (J01CR), macrolides (J01FA), tetracyclines (J01AA), trimethoprim group (J01E), and carbapenems (J01DH).
Figure 78: Top 10 Antibacterial Usage for 2015

Figure 78 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for 30% of total antibacterial usage. Cephalosporins (J01DB, J01DC & J01DD) accounted for a further 7% of usage, fluoroquinolones (J01MA) - 4%, and carbapenems (J01DH) - 3%.

Figure 79: Trends in Specific Antibacterial Group Usage 2006-2015
**Figure 75** shows trends in specific antibacterial usage in Glangwili hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) decreased in 2015.
- Piperacillin/tazobactam (J01CR05) shows a general upward trend, with a small decrease in 2015.
- Cephalosporin usage (J01D) increased in 2015.
- Carbapenem usage (J01DH) decreased in 2015.
- Fluoroquinolone usage (J01MA) shows no significant change from 2012 onwards.
- **Note**: Please note the difference in the y-axis scale for Figure 78 which extends to 500 DDD/1000 BD per quarter.
- Total antibacterial usage appears to have levelled off in 2014/15 (see **Figure 80**).

![Graph showing antibacterial usage trends](image)

**Figure 80: Trends in Total Antibacterial Usage 2006-2015**
**Figure 81: Prince Philip Hospital - Antibacterial Usage for 2012 to 2015**

Figure 81 shows the pattern of antibacterial usage for Prince Philip hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (grey bars).

In 2015, there was an increase in prescribing of beta-lactam/beta-lactamase inhibitor combinations (J01CR), macrolides (J01FA), beta-lactam resistant penicillins (J01CF), broad spectrum penicillins (J01CA), carbapenems (J01DH), fluoroquinolones (J01MA), beta-lactam sensitive penicillins (J01CE), fusidic acid (J01XC), and all cephalosporins (J01DB, J01DC, J01DD); and a decrease in tetracyclines (J01AA), trimethoprim group (J01E), aminoglycosides (J01GB), and glycopeptides (J01XA).
Figure 82: Top 10 Antibacterial Usage for 2015

Figure 82 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for 30% of total antibacterial usage. Cephalosporins (J01DB, J01DC & J01DD) accounted for a further 5% of usage, carbapenems (J01DH) - 5%, and fluoroquinolones (J01MA) - 3%.

Figure 83: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 83 shows trends in specific antibacterial usage in Prince Philip hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows an upward trend.
- Piperacillin/tazobactam (J01CR05) shows an upward trend.
- Cephalosporin usage (J01D) increased in 2015.
- Carbapenem usage (J01DH) shows an upward trend.
- Fluoroquinolone usage (J01MA) increased in 2015.
- Total antibacterial usage increased in 2015 (see Figure 84).

Figure 84: Trends in Total Antibacterial Usage 2006-2015
Figure 85: Withybush Hospital - Antibacterial Usage for 2012 to 2015

Figure 85 shows the pattern of antibacterial usage for Withybush hospital for 2012 (blue bars), 2013 (green bars), 2014 (purple bars), and 2015 (Grey bars).

In 2015, there was an increase in prescribing of a number of antibacterial groups, including beta-lactam/beta-lactamase inhibitor combinations (J01CR), macrolides (J01FA), beta-lactamase resistant penicillins (J01CF), beta-lactamase sensitive penicillins (J01CE), carbapenems (J01DH), aminoglycosides (J01GB) and glycopeptides (J01XA); and a decrease in imidazoles (J01XD), broad spectrum penicillins (J01CA), tetracycline (J01AA), trimethoprim group (J01E), all cephalosporins (J01DB, J01DC, J01DD), and lincosamides (J01F).
Figure 86: Top 10 Antibacterial Usage for 2015

Figure 86 shows the Top 10 antibacterial group usage for 2015; beta-lactam/beta-lactamase inhibitor combinations (J01CR) were the most used antibacterials, accounting for a third of total antibacterial usage (33%). Cephalosporins (J01DB, J01DC & J01DD) accounted for a further 5% of usage, carbapenems (J01DH) - 4%, and fluoroquinolones (J01MA) - 4%.

Figure 87: Trends in Specific Antibacterial Group Usage 2006-2015
Figure 87 shows trends in specific antibacterial usage in Withybush hospital from 2006-2015: co-amoxiclav (J01CR02) and piperacillin/tazobactam (J01CR05), all cephalosporins (J01D), carbapenems (J01DH) and fluoroquinolones (J01MA).

- Co-amoxiclav usage (J01CR02) shows an upward trend, levelling off in 2014/15.
- Piperacillin/tazobactam (J01CR05) shows an upward trend.
- Cephalosporin usage (J01D) and fluoroquinolone usage (J01MA) show a general downward trend across time with some seasonal variation.
- Carbapenem usage (J01DH) shows an upward trend.
- Total antibacterial usage levelled off in 2014/15 (see Figure 88).

Figure 88: Trends in Total Antibacterial Usage 2006-2015
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