Summary Report on Antimicrobials Dispensed in Public Hospitals

Year 2014 - 2016

Infection Control Branch
Centre for Health Protection
Department of Health

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Executive Summary

1. The emergence of antimicrobial resistance (AMR) makes regular treatments for infections less effective and more costly. It is affecting many parts of the world, including both developing and developed countries. Not only it threatens human health but also the overall society development.

2. The Government of the Hong Kong Special Administrative Region recognised the threat of AMR and issued the Hong Kong Strategy and Action Plan on Antimicrobial Resistance (2017-2022) after considering views of various experts and stakeholders from relevant fields. One of the recommended actions is to collect antimicrobials dispensing data[1] from the public hospitals and clinics of public sector as part of overall surveillance.

3. The Hospital Authority (HA) is the government-funded statutory body managing all public hospitals and a number of general outpatient and specialists clinics. It covers about 85% of inpatient service and 25% of outpatient service in Hong Kong. It has an advanced information system capturing all dispensing data through its dispensing service to both inpatient and out-patient service.

4. With the help and support of the Information Technology and Health Informatics Division, and the Strategy and Planning Division of HA, a standardised dispensing data and relevant service statistics from 2014 to 2016 were extracted and provided to the Department of Health (DH) for analysis.

Overview of results

5. From 2014 to 2016 of targeted antimicrobial dispensed from HA, overall Defined Daily Dose (DDD) per 1,000 attendances for all non-inpatient service increased from 303.44 to 323.65 (around 6.66%) with annual increase over 3.28%, while DDD per 1,000 patient-days for all inpatient service increased from 1,040.33 to 1,069.38 (around 2.79%) with an annual average increase of over 1.39%.

[1] Data collected is confined to antibiotics in the Action Plan and this report as the threat of bacterial infection is more serious and imminent than other microbes

6. Among the ten most dispensed antimicrobials for all services, dispensing of amoxicillin/ clavulanate, doxycycline and piperacillin/ tazobactam increased quite sharply from 2014 to 2016 in terms of both quantity (increment in DDD ranged from 97,356 to 1,238,003) and percentage (increment in percentage ranged from 24.27% to 52.58%) while dispensing of ampicillin, cefuroxime and cloxacillin decreased with a range of 25.03% to 28.55%.

7. Overall percentage of patients attended HA non-inpatient service with antimicrobials dispensed remained quite stable at around 3.32% to 3.42% from 2014 to 2016. Accident & Emergency service had the highest percentage of patients with antimicrobials dispensed (range: 9.35% to 9.50%), followed by Primary Care (GOPC) service (range: 3.16% to 3.48%) and Specialist Out-patient (Clinical) service dispensed the least (range: 1.53% to 1.57%). This observation was probably due to the different disease nature of the patients attending these services.

8. While overall percentage of patients attended HA non-inpatient service with antimicrobials dispensed remained quite stable, there was an increase of DDD per 1,000 attendances in all 3 services by 4.43% (Accident & Emergency) to 12.28% (Primary care (GOPC)) from 2014 to 2016. Reasons behind this observation could be multi-factorial and information available is not sufficient to make a conclusion.

9. It was observed that among the ten most dispensed antimicrobials for non-inpatient service, amoxicillin/ clavulanate and doxycycline increased quite sharply from 2014 to 2016 (23.37% and 36.99% respectively) while ampicillin and cloxacillin decreased by 24.03% and 22.88% respectively.

10. For inpatient service, DDD per 1,000 patient-days registered an increase of 2.79% over 2 years from 2014 to 2016 with an annual average increase of 1.39%.

11. Among the ten most dispensed antimicrobials in inpatient service, doxycycline had the highest increase (55.66%) in terms of DDD per 1,000 patient-days, followed by meropenem and piperacillin/ tazobactam (30.60% and 29.60% respectively). The sharpest decrease was seen with ampicillin, cloxacillin and cefuroxime.

12. Among various specialties of inpatient service, ICU/ HDU and Surgery had the highest quantities of antimicrobials dispensed (1841.38 and 1469.44 DDD per 1,000 patient-days respectively in 2016) when compared with other specialties but it is probably due to the very different disease nature of patients being treated by these two specialties.

13. Orthopaedics & Traumatology registered a decrease[2] by 2.39% while both specialties Medicine and Surgery were seen with an increase of 2.56% and 2.31% respectively, which is in-line with the overall increase in DDD per 1,000 patient days for inpatient service from 2014 to 2016. Antimicrobials dispensed in ICU/ HDU remained more or less the same from 2014 to 2016.

14. The overall DDD per 1,000 patient-days of locally-important broad-spectrum antimicrobials was found to have an increase by 23.36% from 2014 to 2016 (Table 14). The increase was observed in all specialties, except ICU/ HDU, ranged from 15.12% (Others) to the highest 41.75% (Orthopaedics and Traumatology) (Table 15).

15. ICU/ HDU registered a slight decrease of 1.28% from 2014 to 2016 but was the specialty with the highest DDD per 1,000 patient-days with the locally-important broad-spectrum antimicrobials dispensed, though it is not unexpected considering the disease status of its patients being treated in ICU/ HDU.

Discussions and Way forward

16. Annual average increase of antimicrobial dispensed in non-inpatient service[3] and inpatient service[4] was rather mild at around 3.28% and 1.39% respectively.

17. The rather sharp increase[5] of the locally-important broad-spectrum antimicrobials such as Piperacillin/ Tazobactam (29.60% over 2 years), and Meropenem (30.60% over 2 years) shall be further examined.

18. Antibiotic Stewardship Programme provides guidance for front-line healthcare providers to choose the most suitable antimicrobial treatment for infections and provides appropriate feedbacks if needed. Adequate resources should be invested in its promulgation and implementation in all healthcare settings.

19. It must be emphasised that results of this report do not contain any information to reflect the appropriateness of use of antimicrobials but aim at providing the annual trend of antimicrobials dispensed in HA from 2014 to 2016.

[2] in DDD per 1,000 patient-days
[3] in DDD per 1,000 attendances
[4] in DDD per 1,000 patient-days
[5] in DDD per 1,000 patient-days

20. In addition, readers of this report are reminded to refrain from making direct comparisons between services and specialties as there are other factors which could affect dispensing quantity of antimicrobial, such as the burden of infectious diseases handled is different among services and specialties. Again it is meant to reflect the annual trend of dispensed antimicrobials for each service and specialty to make their own assessment and evaluation.

21. The results and observation of this report would be shared with our stakeholders, including all healthcare providers and the general public.

22. Antimicrobials are a precious asset for protecting human health and continuous development of modern medicines. Concerted efforts from every member of the society are needed if we want to successfully mitigate threat of AMR to Hong Kong.

1 Introduction

1. Antimicrobial Resistance (AMR) is a global public health concern. AMR results in reduced efficacy of antimicrobials, making the treatment of patients difficult, costly or even impossible.

2. AMR occurs when microorganisms change in ways that render the medications used to cure the infections they caused ineffective.

3. AMR develops when microorganisms adapt and grow in the presence of antimicrobials (including properly used antimicrobials). Resistance develops more rapidly through the misuse and overuse of antimicrobials.

4. Surveillance of antimicrobial use (AMU) can provide information to examine the effectiveness of measures implemented to combat AMR.

> Antimicrobial resistance is a broader term that encompasses resistance to drugs to treat infections caused by pathogens including bacteria, viruses, fungi and parasites. While all are significant to human health, resistance to antimicrobials in bacteria presents an urgent and serious threat to public health.

2 Background

5. The Government of the Hong Kong Special Administrative Region attaches great importance to the threat of AMR and has launched the Hong Kong Strategy and Action Plan on Antimicrobial Resistance (2017-2022) in 2017 to combat the problem[1].

6. AMU monitoring is identified as one of the strategic actions in the Action Plan. It can provide information on level of use and types of antimicrobials for policy-makers and prescribers to examine the effectiveness of measures implemented to combat AMR.

7. In 2017, the Department of Health (DH) collected wholesale supply data through registered wholesalers as a proxy to gauge the overall distribution of antimicrobials among various sectors in Hong Kong. The report was published in April 2018 at the Centre for Health Protection website[2].

8. Further to the wholesale supply report, DH has collaborated with Hospital Authority (HA) to collect dispensing data from public hospitals to understand trend of the antimicrobial dispensed in non-inpatient and inpatient services of public sector.

2.1 Healthcare system of Hong Kong

9. In Hong Kong, around 75% of primary healthcare services are provided by private medical practitioners and there is no statutory requirement for them to provide AMU data to the authority. Hence statistics in this area are sketchy and incomplete.

10. On the other hand, around 70% of secondary healthcare services[6] are provided by HA[7][3].

11. Information on HA dispensing data can contribute to the understanding of the trend of antimicrobial dispensed in inpatient and out-patient services of public sector.

3 Data Sources and Methodology

3.1 Data sources

12. With the help of an advanced information system, HA has been capturing comprehensive dispensing dataset for both non-inpatient and inpatient services

13. Dispensing record of antimicrobials selected based on core set of antimicrobials suggested by the World Health Organization (WHO) to be included in national surveillance program was extracted for analysis (Table 1).

Table 1: Core set of antimicrobials suggested by WHO for AMU surveillance

Group of antimicrobials	Anatomical Therapeutic Chemical (ATC) classification code
Antibacterials for Systemic Use	J01
Antibiotics for alimentary tract	A07AA
Nitroimidazole derivatives for protozoal diseases	P01AB

Note:

[1] External preparations are excluded according to the instruction of WHO.

[6] Secondary healthcare services refer to hospital or inpatient service

[7] in terms of number of hospital beds

14. With the help and support of the Information Technology and Health Informatics Division and Strategy and Planning Division of HA, a standardised dispensing dataset and relevant service statistics from 2014 to 2016 were extracted and provided to DH for analysis:

- Antimicrobial dispensing record with: i) generic name of antimicrobial, ii) strength of antimicrobial dispensed, iii) dosage form, iv) route of administration, v) quantity dispensed, vi) dispensing date, vii) type of service which the drug is dispensed to the patient[8], and viii) specialty of inpatient and day inpatient service[9]
- HA service statistics include total number of attendances for non-inpatient service, and patient-days for inpatient service

15. Antimicrobial dispensing recorded from 2014 to 2016 by calendar year was collected and reported.

3.2 Methodology

16. As different antimicrobials come with different weight for a single dose and have different dosing frequency, therefore dispensing data collected for each drug per route of administration[10] was converted into Defined Daily Dose (DDD)[11] according to the WHO Anatomical Therapeutic Chemical (ATC) classification system, which is a standardised unit adopted by WHO to facilitate comparison. In this report, 2018 version of WHO ATC classification system, and respective DDD constants were adopted.

17. If dosage form information of antimicrobial in dispensing record does not match with the route of administration provided from WHO ATC classification system, such entry was discarded.

[8]Type of services are categorised into: i) Accident & Emergency, ii) Inpatient & Day Inpatient (General Specialities), iii) Primary Care (GOPC), and iv) Specialist Outpatient (Clinical)

[9]Specialities of inpatient & day inpatient service are categorised into: i) Intensive Care Unit/ High Dependency Unit (ICU/ HDU), ii) Medicine, iii) Orthopaedics & Traumatology, iv) Surgery, and v) Other specialties

[10]This implies that same antimicrobial of same strength may be converted to different DDD value for different route of administration.

[11]DDD is defined as the assumed average maintenance dose per day for a drug used for its main indication in adults.

18. In order to adjust for different service volume among different specialties and services, for inpatient service, antimicrobial dispensing data is presented as DDD per 1,000 patient-day[4][12,13] to reflect the amount of antimicrobials dispensed among hospitalised patients.

19. For non-inpatient service, DDD is divided by number of attendance as DDD per 1,000 attendances[14] to reflect the average amount of antimicrobials dispensed.

20. In order to calculate number of non-inpatient attendance with antimicrobial dispensed, for antimicrobials dispensed to one patient within same day from single non-inpatient service, these drugs are assumed to be dispensed for single attendance.

3.3 Antimicrobial names

For simplicity, names of antimicrobial listed in Table 2 are used interchangeably.

Table 2: Interchangeable names of antimicrobial

Name	Alternative Name
Amoxicillin and beta-lactamase inhibitor	Amoxicillin/ Clavulanate
Cefoperazone and beta-lactamase inhibitor	Cefoperazone/ Sulbactam
Piperacillin and beta-lactamase inhibitor	Piperacillin/ Tazobactam
Sulfamethoxazole and trimethoprim	Sulfamethoxazole/trimethoprim

[12]In other countries, it may be presented as DDD per 1,000 bed days, which the definition of a bed day may differ between hospitals or countries.

[13]In HA, patient-days include inpatient patient-days and day inpatient discharges and deaths. Day inpatients refer to those who are admitted into hospitals for non-emergency treatment and who are discharged within the same day. Inpatients are those who are admitted into hospitals via Accident & Emergency Department or those who have stayed for more than one day[5].

[14]In other countries, it may be presented as DDD per 1,000 consultations

4 Results

4.1 Overall annual dispensed quantities and percentage changes in all HA services

21. Table 3 summarises overall antimicrobials dispensed[15] by various HA service types from 2014 to 2016.

22. It was observed an increase of 6.66% for non-inpatient service[16] and 2.79% for inpatient service[17] from 2014 to 2016 respectively.

Table 3: Overall antimicrobial dispensed in various service types

Year	Service Types					
	Non-inpatient Service			Inpatient Service		
	Service Volume*	Antimicrobial†‡	DDD per 1,000 attendances§¶	Service Volume**	Antimicrobial†‡	DDD per 1,000 patient-days§¶
2014	15,542,052	4,716,010	303.44	6,490,394	6,752,180	1,040.33
2015	15,806,229	4,958,607	313.71	6,611,605	6,994,498	1,057.91
2016	16,095,392	5,209,270	323.65	6,966,631	7,449,988	1,069.38

* In terms of attendances

† In terms of DDD

‡ Rounded to the nearest integer

§ Rounded to two decimal places

¶ Due to rounding, percentages may not precisely reflect the absolute figures

** In terms of patient-days

4.1.1 Five most dispensed antimicrobial groups in all HA services

23. Among all the antimicrobials dispensed, the five most dispensed antimicrobials groups[18,19] in 2016 for all HA services were listed in Table 4.

[15] in DDD

[16] in DDD per 1,000 attendances

[17] in DDD per 1,000 patient-days

[18] in DDD

[19] The five most dispensed antimicrobial groups were identified from year 2016 data

24. These five antimicrobial groups together accounted for 91.81%, 92.16% and 92.47% of overall antimicrobials dispensed by HA from 2014 to 2016 respectively.

25. Tetracyclines group registered the biggest increase in dispensing quantity by 43.94% while other beta-lactam antibacterials group registered a decrease by 3.60%.

Table 4: Five most dispensed antimicrobial groups in year 2016 in all HA services (by WHO ATC classification)

ATC Pharmacological Subgroup		Antimicrobial dispensed in DDD			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)†‡
J01C	Beta-Lactam Antibacterials, Penicillins	7,222,226	7,671,541	8,168,394	13.10%
J01M	Quinolone Antibacterials	963,473	998,429	1,010,965	4.93%
J01F	Macrolides, Lincosamides and Streptogramins	933,319	883,291	954,777	2.30%
J01D	Other Beta-Lactam Antibacterials	962,700	928,124	927,997	-3.60%
J01A	Tetracyclines	446,934	535,124	643,337	43.94%

* Rounded to the nearest integer

† Rounded to two decimal places

‡ Due to rounding, percentages may not precisely reflect the absolute figures

4.1.2 Ten most dispensed antimicrobials in all HA services

26. For individual antimicrobial, the ten most dispensed antimicrobials[20,21] in 2016 in all HA services were listed in Table 5.

27. These 10 antimicrobials together accounted for 82.48%, 83.07% and 83.08% of overall antimicrobials dispensed in all HA services from 2014 to 2016 respectively.

28. The most dispensed antimicrobial was amoxicillin/ clavulanate in three consecutive years. It accounted for 44.48%, 47.89% and 50.07% of all antimicrobials dispensed from 2014 to 2016 respectively.

[20] in DDD

[21] The ten most dispensed antimicrobials were identified from year 2016 data

29. From 2014 to 2016, doxycycline registered the highest percentage increase [22] by 52.58%, followed by piperacillin/ tazobactam (38.94%) and amoxicillin/ clavulanate (24.27%).

30. From 2014 to 2016, ampicillin registered the highest decrease [23] by 28.55%, followed by cefuroxime (26.88%) and cloxacillin (25.03%).

Table 5: The ten most dispensed antimicrobials in all HA services

ATC Chemical Substance		Antimicrobial dispensed in DDD			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)†‡
J01CR02	Amoxicillin/ Clavulanate	5,100,534	5,724,085	6,338,536	24.27%
J01MA12	Levofloxacin	684,025	708,162	733,549	7.24%
J01FA09	Clarithromycin	612,409	554,371	583,222	-4.77%
J01AA02	Doxycycline	376,846	465,748	575,008	52.58%
J01CF02	Cloxacillin	686,979	607,710	515,002	-25.03%
J01CA04	Amoxicillin	493,968	449,668	449,054	-9.09%
J01CA01	Ampicillin	535,005	457,465	382,267	-28.55%
J01CR05	Piperacillin/ Tazobactam	250,038	307,238	347,394	38.94%
J01DC02	Cefuroxime	455,261	381,014	332,895	-26.88%
J01MA02	Ciprofloxacin	264,108	273,619	260,535	-1.35%

* Rounded to the nearest integer

† Rounded to two decimal places

‡ Due to rounding, percentages may not precisely reflect the absolute figures

[22] in DDD

[23] in DDD

4.2 Overall annual dispensed quantities and percentage changes in HA non-inpatient service

31. Table 6 summarises overall antimicrobials dispensed in HA non-inpatient service, respective attendance statistics and percentage of attendance with antimicrobials dispensed from 2014 to 2016.

32. It was observed an increase of 6.66% [24] for all non-inpatient service from 2014 to 2016.

33. The percentage of attendance with antimicrobials dispensed from 2014 to 2016 remained quite stable at around 3.32%, 3.36% and 3.42% respectively.

[24] in DDD per 1,000 attendances

Table 6: Summary on attendance count and antimicrobials dispensed in HA non-inpatient service

Year		Primary Care (GOPC)	Specialist Out-patient (Clinical)	Accident & Emergency	All Non-inpatient Services
2014	Total DDD of antimicrobials dispensed*	1,433,419	1,708,461	1,574,130	4,716,010
	Total number of attendance	6,173,988	7,141,161	2,226,903	15,542,052
	No. of attendance with antimicrobials dispensed†	194,855	110,599	210,593	516,047
	Percentage of attendance with antimicrobials dispensed‡§	3.16%	1.55%	9.46%	3.32%
	DDD per 1,000 attendances‡§¶	232.17	239.24	706.87	303.44
2015	Total DDD of antimicrobials dispensed*	1,547,034	1,775,411	1,636,163	4,958,607
	Total number of attendance	6,275,792	7,304,951	2,225,486	15,806,229
	No. of attendance with antimicrobials dispensed†	207,148	111,897	211,372	530,417
	Percentage of attendance with antimicrobials dispensed‡§	3.30%	1.53%	9.50%	3.36%
	DDD per 1,000 attendances‡§¶	246.51	243.04	735.19	313.71
2016	Total DDD of antimicrobials dispensed*	1,657,792	1,883,535	1,667,942	5,209,270
	Total number of attendance	6,359,607	7,476,202	2,259,583	16,095,392
	No. of attendance with antimicrobials dispensed†	221,499	117,351	211,276	550,126
	Percentage of attendance with antimicrobials dispensed‡§	3.48%	1.57%	9.35%	3.42%
	DDD per 1,000 attendances‡§¶	260.68	251.94	738.16	323.65

* Rounded to the nearest integer

† Number of attendance with antimicrobials dispensed is defined as the annual sum of daily number of patient with antimicrobial dispensed in each cluster and each specialty

‡ Rounded to two decimal places

§ Due to rounding, figures may not precisely reflect the absolute figures

¶ Attendance refers to total attendance

4.2.1 Five most dispensed antimicrobial groups in HA non-inpatient service

34. Among all antimicrobials dispensed, the five most dispensed antimicrobial groups[25,26] in HA non-inpatient service from 2014 to 2016 were listed in Table 7.

35. These five antimicrobial groups accounted for 93.05%, 93.33% and 93.55% of overall antimicrobials dispensed in non-inpatient service from 2014 to 2016 respectively.

Table 7: The five most dispensed antimicrobial groups dispensed in HA non-inpatient service

ATC Pharmacological Subgroup		DDD per 1,000 attendances			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01C	Beta-Lactam Antibacterials, Penicillins	194.18	202.81	209.08	7.67%
J01F	Macrolides, Lincosamides and Streptogramins	35.58	34.16	36.63	2.94%
J01A	Tetracyclines	17.70	21.11	22.36	26.32%
J01M	Quinolone Antibacterials	21.88	22.46	22.14	1.20%
J01X	Other Antibacterials	13.00	12.25	12.56	-3.43%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

Note:

[1] The five most dispensed antimicrobial groups were identified from year 2016 data

4.2.2 Ten most dispensed antimicrobials in HA non-inpatient service

36. For individual antimicrobials, the ten most dispensed antimicrobials[27,28] from 2014 to 2016 were listed in Table 8.

37. These ten antimicrobials together accounted for 89.22%, 89.64% and 89.84% of the overall antimicrobials dispensed in HA non-inpatient service from 2014 to 2016 respectively.

38. Amoxicillin/ clavulanate alone accounted for 40.10%, 44.13% and 46.38% of the overall antimicrobials dispensed from 2014 to 2016 respectively.

[25]The five most dispensed antimicrobial groups were identified from year 2016 data

[26]in DDD per 1,000 attendances

[27]The ten most dispensed antimicrobial are identified from year 2016 data

[28]in DDD per 1,000 attendances

39. Antimicrobial with the biggest increase in dispensing from 2014 to 2016 was doxycycline (36.99%) followed by amoxicillin/ clavulanate (23.37%) while biggest decrease was ampicillin (24.03%) and cloxacillin (22.88%).

Table 8: The ten most dispensed antimicrobials in HA non-inpatient service

ATC Chemical Substance		DDD per 1,000 attendances			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	121.68	138.45	150.11	23.37%
J01FA09	Clarithromycin	24.29	22.71	24.48	0.78%
J01CA04	Amoxicillin	25.47	22.86	22.11	-13.18%
J01CF02	Cloxacillin	24.93	22.10	19.22	-22.88%
J01AA02	Doxycycline	13.94	17.55	19.10	36.99%
J01CA01	Ampicillin	18.28	15.81	13.89	-24.03%
J01MA12	Levofloxacin	12.66	13.15	13.50	6.63%
J01XE01	Nitrofurantoin	12.51	11.82	12.05	-3.73%
J01MA02	Ciprofloxacin	8.76	8.94	8.27	-5.51%
J01EE01	Sulfamethoxazole/ Trimethoprim	8.21	7.84	8.04	-2.10%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

Note:

[1] The ten most dispensed antimicrobials were identified from year 2016 data

4.2.3 Antimicrobial dispensed in HA non-inpatient service, stratified by service type

40. Table 9 presents the overall antimicrobials dispensed, stratified by service type in non-inpatient service[29].

41. It was observed that there was increase in terms of DDD per 1,000 attendances for Primary Care (GOPC), 5.31% increase for Specialist Out-patient (Clinical) and 4.43% increase for Accident & Emergency from 2014 to 2016 respectively.

[29] in DDD per 1,000 attendances

42. The rather big difference[30] between Accident & Emergency; and Primary Care (GOPC) and Specialist Out-patient (Clinical) were probably due to different disease profile of patients attending.

Table 9: Overall antimicrobials dispensed in HA non-inpatient service, stratified by service type

Service Type	DDD per 1,000 attendances			
	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
Primary Care (GOPC)	232.17	246.51	260.68	12.28%
Specialist Out-patient (Clinical)	239.24	243.04	251.94	5.31%
Accident & Emergency	706.87	735.19	738.16	4.43%
All Non-inpatient Services	303.44	313.71	323.65	6.66%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

4.3 Overall annual dispensed quantities and percentage changes in HA inpatient service

43. Table 10 summarises the overall antimicrobials dispensed in HA inpatient service from 2014 to 2016.

44. It was observed that there was an increase in total DDD by 10.33% from 2014 to 2016 but the percentage increase was 2.79% when in terms of DDD per 1,000 patient-days. The discrepancy between DDD and DDD per 1,000 patient-days may be able to be explained by the 7.34% increase in patient-days, i.e. more patients being treated, from 2014 to 2016 [31].

[30] in DDD per 1,000 attendances

[31] Refer to table 3

Table 10: Summary on number of patient-days and antimicrobials dispensed in HA inpatient service

	Year 2014	Year 2015	Year 2016	Percentage change (2014 vs 2016)[†‡]
Total DDD of antimicrobials dispensed [*]	6,752,180	6,994,498	7,449,988	10.33%
Total number of patient-days [*]	6,490,394	6,611,605	6,966,631	7.34%
DDD per 1,000 patient-days [†]	1,040.33	1,057.91	1,069.38	2.79%

[*] Rounded to the nearest integer

[†] Rounded to two decimal places

[‡] Due to rounding, percentages may not precisely reflect the absolute figures

4.3.1 Five most dispensed antimicrobial groups in HA inpatient service

45. Among all antimicrobials dispensed in inpatient service, the five most dispensed antimicrobial groups[32,33] from 2014 to 2016 were listed in Table 11.

46. These five most dispensed antimicrobial groups accounted for 92.16%, 92.48% and 92.99% of the overall antimicrobials dispensed from 2014 to 2016 respectively.

47. Beta-lactam antibacterials, penicillins group alone accounted for 62.26%, 63.85% and 64.47% of overall antimicrobials dispensed in inpatient service from 2014 to 2016 respectively.

48. Tetracyclines group ranked the fifth most dispensed antimicrobial group in 2016 but there was 53.67% increase when compared with that in 2014[34].

[32]The five most dispensed antimicrobial groups were identified from year 2016 data

[33]in DDD per 1,000 patient-days

[34]in DDD per 1,000 patient-days

Table 11: Five most dispensed ATC Pharmacological Subgroup in HA inpatient service

ATC Pharmacological Subgroup		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01C	Beta-Lactam Antibacterials, Penicillins	647.76	675.46	689.45	6.44%
J01D	Other Beta-Lactam Antibacterials	129.84	123.13	117.92	-9.18%
J01M	Quinolone Antibacterials	96.05	97.32	93.96	-2.18%
J01F	Macrolides, Lincosamides and Streptogramins	58.59	51.94	52.43	-10.52%
J01A	Tetracyclines	26.48	30.47	40.69	53.67%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

4.3.2 Ten most dispensed antimicrobials in HA inpatient service

49. For individual antimicrobial, the ten most antimicrobials[35] dispensed in HA inpatient service[36] from 2014 to 2016 were listed in Table 12.

50. These ten most dispensed antimicrobials together accounted for 81.89%, 82.73% and 83.23% of the overall antimicrobials dispensed in inpatient service from 2014 to 2016 respectively.

51. Similar in non-inpatient service, amoxicillin/ clavulanate alone accounted for 47.53%, 50.55% and 52.65% of the overall use from 2014 to 2016 respectively

52. It was also observed the biggest percentage increase among these ten most dispensed antimicrobials from 2014 to 2016 was doxycycline (55.66%), followed by meropenem (30.60%) and piperacillin/ tazobactam (29.60%), while the antimicrobial showing the biggest decreases within the same period were ampicillin (41.06%) and cloxacillin (36.06%).

[35]The ten most dispensed antimicrobials were identified from year 2016 data

[36]in DDD per 1,000 patient-days

Table 12: Ten most dispensed antimicrobials in HA inpatient service

ATC Chemical Substance		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	494.48	534.78	563.03	13.86%
J01MA12	Levofloxacin	75.07	75.68	74.11	-1.29%
J01CR05	Piperacillin/ Tazobactam	38.47	46.45	49.85	29.60%
J01AA02	Doxycycline	24.68	28.48	38.42	55.66%
J01DC02	Cefuroxime	54.47	43.03	35.13	-35.51%
J01CF02	Cloxacillin	46.15	39.09	29.51	-36.06%
J01FA09	Clarithromycin	36.20	29.54	27.17	-24.95%
J01DH02	Meropenem	19.94	24.00	26.04	30.60%
J01DD04	Ceftriaxone	23.83	22.80	23.98	0.61%
J01CA01	Ampicillin	38.65	31.40	22.78	-41.06%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

4.3.3 Ten most dispensed antimicrobials in HA inpatient service, stratified by specialty

53. Table 13 presents the overall antimicrobials dispensed stratified by specialty in HA inpatient service[37].

54. Differences[38] among various specialties were probably due to the very much different disease natures of patients treated under the different specialties.

55. It was observed that there was 2.79% increase[39] of antimicrobials dispensed in inpatient service from 2014 to 2016.

56. Stratified by specialty, Medicine and Surgery were the two specialties that had the biggest increase (2.56% and 2.31% respectively) while decrease was observed in Orthopaedics & Traumatology in terms of DDD per 1,000 patient-days (2.39%)[40].

[37] in DDD per 1,000 patient-days

[38] in DDD per 1,000 patient-days

[39] in DDD per 1,000 patient-days

[40] "Others" specialty was not included in this analysis

Table 13: Overall antimicrobials dispensed in HA inpatient service, stratified by specialty

Specialty	DDD per 1,000 patient-days			
	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
Medicine	1,126.68	1,151.24	1,155.56	2.56%
Surgery	1,436.27	1,482.05	1,469.44	2.31%
Orthopaedics & Traumatology	1,044.93	1,043.27	1,019.94	-2.39%
ICU/ HDU	1,835.37	1,732.47	1,841.38	0.33%
Others	668.72	668.73	715.78	7.04%
All inpatients	1,040.33	1,057.91	1,069.38	2.79%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

4.4 Overall annual dispensed quantities and percentage change of locally-important broad-spectrum antimicrobials in all HA services

57. Among all the antimicrobials, there are some broad-spectrum antimicrobials with local importance and interest. They are normally reserved for resistant infections when first line antimicrobials failed to cure the infection. Table 14 presents the quantity of the locally-important broad-spectrum antimicrobials dispensed in HA inpatient service from 2014 to 2016.

58. These antimicrobials accounted for 8.27%, 9.52% and 9.92% of the overall antimicrobials dispensed in inpatient service[41] in HA from 2014 to 2016 respectively.

[41] DDD per 1,000 patient-days

Table 14: Broad-spectrum antimicrobials dispensed in HA inpatient service

WHO ATC		DDD per 1,000 patient-days			
Pharmacological Subgroup	Chemical Substance	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
Beta-Lactam Antibacterials, Penicillins	Piperacillin/ Tazobactam	38.47	46.45	49.85	29.60%
Other Beta-Lactam Antibacterials	Meropenem	19.94	24	26.04	30.60%
Other Antibacterials	Vancomycin‡	11.4	12.59	13.26	16.30%
Other Beta-Lactam Antibacterials	Cefoperazone/ Sulbactam	4.69	4.63	4.47	-4.71%
Other Beta-Lactam Antibacterials	Ceftazidime	2.72	3.35	3.31	21.82%
Other Beta-Lactam Antibacterials	Cefepime	2.28	3.2	3.29	44.61%
Other Antibacterials	Colistin	2.47	2.47	2.01	-18.76%
Other Antibacterials	Linezolid	1.68	1.57	1.71	1.70%
Other Beta-Lactam Antibacterials	Imipenem and Cilastatin	1.78	1.68	1.29	-27.22%
Other Antibacterials	Daptomycin	0.53	0.75	0.84	58.84%
Other Antibacterials	Teicoplanin	0.09	0.09	0.07	-28.74%
	Total	86.03	100.76	106.13	23.36%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

‡ Only parenteral vancomycin (WHO ATC Chemical Substance Code J01XA01) was included for analysis

Note:

[1] Antimicrobials are ordered by descending order of dispensed quantity in year 2016

4.4.1 Locally-important broad-spectrum antimicrobial dispensed in HA inpatient service, stratified by specialty

59. Table 15 summarises the locally-important broad-spectrum antimicrobials dispensed when stratified by specialty.

60. There was a general increase of use of broad-spectrum antimicrobials in Orthopaedics and Traumatology, Surgery and Medicine (41.75% and 31.27% and 24.66% respectively) except in ICU/ HDU which was observed to have a decrease by 1.28% from 2014 to 2016.

61. It was observed that ICU/ HDU was by far the specialty with the largest quantity of broad-spectrum antimicrobials dispensed[42] when compared with other three specialties (over 4 to 10 times). It is not unexpected as majority of patients with the most resistant infections are most likely to be treated in ICU/ HDU with one or more antimicrobials and hence the much higher DDD per 1,000 patient-days than that of other specialties.

Table 15: Broad-spectrum antimicrobials dispensed in HA inpatient service, stratified by specialty

Specialty	DDD per 1,000 patient-days			
	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
Medicine	110.08	131.62	137.22	24.66%
Surgery	77.62	92.78	101.90	31.27%
Orthopaedics and Traumatology	42.19	49.93	59.81	41.75%
ICU/ HDU	643.94	597.66	635.69	-1.28%
Others	46.13	52.64	53.11	15.12%
All inpatients	86.03	100.76	106.13	23.36%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

[42] in DDD per 1,000 patient-days

5 Discussion

5.1 Data interpretation and limitations

62. Results of this report are based on data captured from the HA dispensing system and are only intended to reflect the annual trend of various antimicrobials dispensed through this system. It is not meant to gauge the appropriateness of the prescribed antimicrobial for infectious diseases on whether the right dose and the duration were given. For assessment on prescription appropriateness, other information including but not limited to clinical symptoms, laboratory results, other epidemiological information such as age, sex, comorbidity, medication history are needed.

63. Since information for anonymously identifying individual non-inpatient attendance[43] was not available, as discussed in Section 3.2, assumptions have been made to estimate number of non-inpatient attendance with antimicrobials dispensed, this may result in underestimation of the figure.

64. During analysis, ambiguity on route of administration information was observed in the dataset. Since information on route of administration is required in WHO ATC classification system for DDD conversion, after discussion with HA, a consensus has been reached that form unit of the drug will be used to determine route of administration if this piece of information is not available in dispensing record[44].

65. Furthermore, it was observed that the pharmaceutical dosage form of some antimicrobials did not match with the prescribed route of administration. Readers should pay attention to vancomycin, as it classified both as an intestinal antiinfectives[45] and a glycopeptide antibacterials[46]. The DDD under J01XA01 only included those vancomycin prescribed with assigned route of administration being parenteral, while those vancomycin prescribed to be given orally, even the pharmaceutical dosage form is for parenteral use[47], would be assigned under A07AA, as there is no registered vancomycin product in HK comes in oral dosage form.

[43] such as out-patient consultation number

[44] For example, antimicrobial in oral solid is assumed to be taken orally, while those in vial is assumed to be taken parenterally.

[45] coded as A07AA09 in WHO ATC classification system

[46] coded as J01XA01 in WHO ATC classification system

[47] in vial

66. Readers are reminded to refrain from making direct cross-service or cross-specialty comparisons of the results as there are other factors which could affect the dispensed quantity for each service and specialty, such as case-mix. The DDD figures[48] are only meant to reflect the annual trend of antimicrobial dispensed under that service or specialty.

5.2 Way forward

67. Collecting antimicrobial dispensing data as routine AMU surveillance can be used for several purposes, such as: i) to raise awareness on appropriate use of antimicrobial, ii) to inform stakeholders of their performance and prescribed quantities of various antimicrobials, and iii) to consider whether it is necessary to make changes to existing prescribing policy and/ or to strengthen Antibiotic Stewardship Programme.

68. AMR is a threat to all members of the general public regardless of race, age and gender. Coordinated joint effort from every sectors and stakeholders is the only way to lessen and mitigate the threat.

69. In conclusion, antimicrobial is a very precious resource for modern medicine and should only be used judiciously to preserve its effectiveness or human race may fall back to pre-antibiotic era.

[48] DDD per 1,000 attendances for non-inpatient service and DDD per 1,000 patient-days for inpatient service

6 Annex

6.1 List of antimicrobials recommended by WHO for inclusion in surveillance

70. A core set of antimicrobials recommended by WHO for inclusion in surveillance of antimicrobial consumption[6] is listed below, antimicrobials ended with asterisk (*) are those with dispensing data provided from HA for analysis in this report.

71. Antimicrobials listed below are based on 2018 version of WHO ATC Index[7].

Table 16: List of antimicrobials under WHO ATC pharmacological subgroup Tetracyclines (J01A)

Tetracyclines (J01AA)	
1. Demeclocycline (J01AA01)	8. Minocycline (J01AA08)*
2. Doxycycline (J01AA02)*	9. Rolitetracycline (J01AA09)
3. Chlortetracycline (J01AA03)	10. Penimepicycline (J01AA10)
4. Lymecycline (J01AA04)	11. Clomocycline (J01AA11)
5. Metacycline (J01AA05)	12. Tigecycline (J01AA12)*
6. Oxytetracycline (J01AA06)*	13. Combinations of tetracyclines (J01AA20)
7. Tetracycline (J01AA07)*	14. Oxytetracycline, combinations (J01AA56)

Table 17: List of antimicrobials under WHO ATC pharmacological subgroup Amphenicols (J01B)

Amphenicols (J01BA)	
1. Chloramphenicol (J01BA01)	3. Thiamphenicol, combinations (J01BA52)
2. Thiamphenicol (J01BA02)	

Table 18: List of antimicrobials under WHO ATC pharmacological subgroup Beta-Lactam Antibacterials, Penicillins (J01C)

Penicillins with extended spectrum (J01CA)

1. Ampicillin (J01CA01)*
2. Pivampicillin (J01CA02)
3. Carbenicillin (J01CA03)
4. Amoxicillin (J01CA04)*
5. Carindacillin (J01CA05)
6. Bacampicillin (J01CA06)
7. Epicillin (J01CA07)
8. Pivmecillinam (J01CA08)
9. Azlocillin (J01CA09)
10. Mezlocillin (J01CA10)
11. Mecillinam (J01CA11)
12. Piperacillin (J01CA12)*
13. Ticarcillin (J01CA13)
14. Metampicillin (J01CA14)
15. Talampicillin (J01CA15)
16. Sulbenicillin (J01CA16)
17. Temocillin (J01CA17)
18. Hetacillin (J01CA18)
19. Aspoxicillin (J01CA19)
20. Combinations (J01CA20)
21. Ampicillin, combinations (J01CA51)

Beta-lactamase sensitive penicillins (J01CE)

1. Benzylpenicillin (J01CE01)*
2. Phenoxymethylpenicillin (J01CE02)*
3. Propicillin (J01CE03)
4. Azidocillin (J01CE04)
5. Pheneticillin (J01CE05)
6. Penamecillin (J01CE06)
7. Clometocillin (J01CE07)
8. Benzathine benzylpenicillin (J01CE08)*
9. Procaine benzylpenicillin (J01CE09)*
10. Benzathine phenoxymethylpenicillin (J01CE10)
11. Combinations (J01CE30)

Beta-lactamase resistant penicillins (J01CF)

1. Dicloxacillin (J01CF01)
2. Cloxacillin (J01CF02)*
3. Meticillin (J01CF03)
4. Oxacillin (J01CF04)
5. Flucloxacillin (J01CF05)*
6. Nafcillin (J01CF06)

Beta-lactamase inhibitors (J01CG)

1. Sulbactam (J01CG01)
2. Tazobactam (J01CG02)

Combinations of penicillins, incl. beta-lactamase inhibitors (J01CR)

1. Ampicillin and beta-lactamase inhibitor (J01CR01)*
2. Amoxicillin and beta-lactamase inhibitor (J01CR02)*
3. Ticarcillin and beta-lactamase inhibitor (J01CR03)*
4. Sultamicillin (J01CR04)*
5. Piperacillin and beta-lactamase inhibitor (J01CR05)*
6. Combinations of penicillins (J01CR50)

Table 19: List of antimicrobials under WHO ATC pharmacological subgroup Other Beta-Lactam Antibacterials (J01D)

First-generation cephalosporins (J01DB)

1. Cefalexin (J01DB01)*
2. Cefaloridine (J01DB02)
3. Cefalotin (J01DB03)
4. Cefazolin (J01DB04)*
5. Cefadroxil (J01DB05)
6. Cefazedone (J01DB06)
7. Cefatrizine (J01DB07)
8. Cefapirin (J01DB08)
9. Cefradine (J01DB09)
10. Cefacetrile (J01DB10)
11. Cefroxadine (J01DB11)
12. Ceftezole (J01DB12)

Second-generation cephalosporins (J01DC)

1. Cefoxitin (J01DC01)*
2. Cefuroxime (J01DC02)*
3. Cefamandole (J01DC03)
4. Cefaclor (J01DC04)*
5. Cefotetan (J01DC05)
6. Cefonicid (J01DC06)
7. Cefotiam (J01DC07)
8. Loracarbef (J01DC08)
9. Cefmetazole (J01DC09)
10. Cefprozil (J01DC10)
11. Ceforanide (J01DC11)
12. Cefminox (J01DC12)
13. Cefbuperazone (J01DC13)
14. Flomoxef (J01DC14)

Third-generation cephalosporins (J01DD)

1. Cefotaxime (J01DD01)*
2. Ceftazidime (J01DD02)*
3. Cefsulodin (J01DD03)
4. Ceftriaxone (J01DD04)*
5. Cefmenoxime (J01DD05)
6. Latamoxef (J01DD06)
7. Ceftizoxime (J01DD07)
8. Cefixime (J01DD08)
9. Cefodizime (J01DD09)
10. Cefetamet (J01DD10)
11. Cefpiramide (J01DD11)
12. Cefoperazone (J01DD12)
13. Cefpodoxime (J01DD13)
14. Ceftibuten (J01DD14)*
15. Cefdinir (J01DD15)
16. Cefditoren (J01DD16)
17. Cefcapene (J01DD17)
18. Cefotaxime and beta-lactamase inhibitor (J01DD51)
19. Ceftazidime and beta-lactamase inhibitor (J01DD52)
20. Ceftriaxone, combinations (J01DD54)
21. Cefoperazone and beta-lactamase inhibitor (J01DD62)*
22. Ceftriaxone and beta-lactamase inhibitor (J01DD63)

Fourth-generation cephalosporins (J01DE)

1. Cefepime (J01DE01)*
2. Cefpirome (J01DE02)
3. Cefozopran (J01DE03)

Table 19: List of antimicrobials under WHO ATC pharmacological subgroup Other Beta-Lactam Antibacterials (J01D) *(continued)*

Monobactams (J01DF)	
1. Aztreonam (J01DF01)*	2. Carumonam (J01DF02)
Carbapenems (J01DH)	
1. Meropenem (J01DH02)*	4. Biapenem (J01DH05)
2. Ertapenem (J01DH03)*	5. Imipenem and cilastatin (J01DH51)*
3. Doripenem (J01DH04)	6. Panipenem and betamipron (J01DH55)
Other cephalosporins and penems (J01DI)	
1. Ceftobiprole medocaril (J01DI01)	3. Faropenem (J01DI03)
2. Ceftaroline fosamil (J01DI02)*	4. Ceftolozane and beta-lactamase inhibitor (J01DI54)*

Table 20: List of antimicrobials under WHO ATC pharmacological subgroup Sulfonamides and Trimethoprim (J01E)

Trimethoprim and derivatives (J01EA)

1. Trimethoprim (J01EA01)*
2. Brodimoprim (J01EA02)
3. Iclaprim (J01EA03)

Short-acting sulfonamides (J01EB)

1. Sulfaisodimidine (J01EB01)
2. Sulfamethizole (J01EB02)
3. Sulfadimidine (J01EB03)
4. Sulfapyridine (J01EB04)
5. Sulfafurazole (J01EB05)
6. Sulfanilamide (J01EB06)
7. Sulfathiazole (J01EB07)
8. Sulfathiourea (J01EB08)
9. Combinations (J01EB20)

Intermediate-acting sulfonamides (J01EC)

1. Sulfamethoxazole (J01EC01)
2. Sulfadiazine (J01EC02)*
3. Sulfamoxole (J01EC03)
4. Combinations (J01EC20)

Long-acting sulfonamides (J01ED)

1. Sulfadimethoxine (J01ED01)
2. Sulfalene (J01ED02)
3. Sulfametomidine (J01ED03)
4. Sulfametoxydiazine (J01ED04)
5. Sulfamethoxypyridazine (J01ED05)
6. Sulfaperin (J01ED06)
7. Sulfamerazine (J01ED07)
8. Sulfaphenazole (J01ED08)
9. Sulfamazone (J01ED09)
10. Combinations (J01ED20)

Combinations of sulfonamides and trimethoprim, incl. derivatives (J01EE)

1. Sulfamethoxazole and trimethoprim (J01EE01)*
2. Sulfadiazine and trimethoprim (J01EE02)
3. Sulfametrole and trimethoprim (J01EE03)
4. Sulfamoxole and trimethoprim (J01EE04)
5. Sulfadimidine and trimethoprim (J01EE05)
6. Sulfadiazine and tetroxoprim (J01EE06)
7. Sulfamerazine and trimethoprim (J01EE07)

Table 21: List of antimicrobials under WHO ATC pharmacological subgroup Macrolides, Lincosamides and Streptogramins (J01F)

Macrolides (J01FA)	
1. Erythromycin (J01FA01)*	9. Azithromycin (J01FA10)*
2. Spiramycin (J01FA02)	10. Miocamycin (J01FA11)
3. Midecamycin (J01FA03)	11. Rokitamycin (J01FA12)
4. Oleandomycin (J01FA05)	12. Dirithromycin (J01FA13)
5. Roxithromycin (J01FA06)	13. Flurithromycin (J01FA14)
6. Josamycin (J01FA07)	14. Telithromycin (J01FA15)
7. Troleandomycin (J01FA08)	15. Solithromycin (J01FA16)
8. Clarithromycin (J01FA09)*	
Lincosamides (J01FF)	
1. Clindamycin (J01FF01)*	2. Lincomycin (J01FF02)
1. Pristinamycin (J01FG01)	2. Quinupristin/dalfopristin (J01FG02)

Table 22: List of antimicrobials under WHO ATC pharmacological subgroup Aminoglycoside Antibacterials (J01G)

Streptomycins (J01GA)	
1. Streptomycin (J01GA01)*	2. Streptoduocin (J01GA02)
Other aminoglycosides (J01GB)	
1. Tobramycin (J01GB01)*	7. Sisomicin (J01GB08)
2. Gentamicin (J01GB03)*	8. Dibekacin (J01GB09)
3. Kanamycin (J01GB04)*	9. Ribostamycin (J01GB10)
4. Neomycin (J01GB05)*	10. Isepamicin (J01GB11)
5. Amikacin (J01GB06)*	11. Arbekacin (J01GB12)
6. Netilmicin (J01GB07)	12. Bekanamycin (J01GB13)

Table 23: List of antimicrobials under WHO ATC pharmacological subgroup Quinolone Antibacterials (J01M)

Fluoroquinolones (J01MA)	
1. Ofloxacin (J01MA01)*	11. Grepafloxacin (J01MA11)
2. Ciprofloxacin (J01MA02)*	12. Levofloxacin (J01MA12)*
3. Pefloxacin (J01MA03)	13. Trovafloxacin (J01MA13)
4. Enoxacin (J01MA04)	14. Moxifloxacin (J01MA14)*
5. Temafloxacin (J01MA05)	15. Gemifloxacin (J01MA15)
6. Norfloxacin (J01MA06)	16. Gatifloxacin (J01MA16)
7. Lomefloxacin (J01MA07)	17. Prulifloxacin (J01MA17)
8. Fleroxacin (J01MA08)	18. Pazufloxacin (J01MA18)
9. Sparfloxacin (J01MA09)	19. Garenoxacin (J01MA19)
10. Rufloxacin (J01MA10)	20. Sitafloxacin (J01MA21)
Other quinolones (J01MB)	
1. Rosoxacin (J01MB01)	5. Oxolinic acid (J01MB05)
2. Nalidixic acid (J01MB02)	6. Cinoxacin (J01MB06)
3. Piromidic acid (J01MB03)	7. Flumequine (J01MB07)
4. Pipemidic acid (J01MB04)	8. Nemonoxacin (J01MB08)

Table 24: List of antimicrobials under WHO ATC pharmacological subgroup Combinations of Antibacterials (J01R)

Combinations of antibacterials (J01RA)	
1. Penicillins, combinations with other antibacterials (J01RA01)	8. Tetracycline and oleandomycin (J01RA08)
2. Sulfonamides, combinations with other antibacterials (excl. trimethoprim) (J01RA02)	9. Ofloxacin and ornidazole (J01RA09)
3. Cefuroxime and metronidazole (J01RA03)	10. Ciprofloxacin and metronidazole (J01RA10)
4. Spiramycin and metronidazole (J01RA04)	11. Ciprofloxacin and tinidazole (J01RA11)
5. Levofloxacin and ornidazole (J01RA05)	12. Ciprofloxacin and ornidazole (J01RA12)
6. Cefepime and amikacin (J01RA06)	13. Norfloxacin and tinidazole (J01RA13)
7. Azithromycin, fluconazole and secnidazole (J01RA07)	

Table 25: List of antimicrobials under WHO ATC pharmacological subgroup Other Antibacterials (J01X)

Glycopeptide antibacterials (J01XA)

1. Vancomycin (J01XA01)*
2. Teicoplanin (J01XA02)*
3. Telavancin (J01XA03)
4. Dalbavancin (J01XA04)
5. Oritavancin (J01XA05)

Polymyxins (J01XB)

1. Colistin (J01XB01)*
2. Polymyxin B (J01XB02)

Steroid antibacterials (J01XC)

1. Fusidic acid (J01XC01)*

Imidazole derivatives (J01XD)

1. Metronidazole (J01XD01)*
2. Tinidazole (J01XD02)
3. Ornidazole (J01XD03)

Nitrofuran derivatives (J01XE)

1. Nitrofurantoin (J01XE01)*
2. Nifurtoinol (J01XE02)
3. Furazidin (J01XE03)
4. Nitrofurantoin, combinations (J01XE51)

Other antibacterials (J01XX)

1. Fosfomycin (J01XX01)*
2. Xibornol (J01XX02)
3. Clofoctol (J01XX03)
4. Spectinomycin (J01XX04)
5. Methenamine (J01XX05)
6. Mandelic acid (J01XX06)
7. Nitroxoline (J01XX07)
8. Linezolid (J01XX08)*
9. Daptomycin (J01XX09)*
10. Bacitracin (J01XX10)
11. Tedizolid (J01XX11)

Table 26: List of antimicrobials under WHO ATC pharmacological subgroup Agents Against Amoebiasis and Other Protozoal Diseases (P01A)

Nitroimidazole derivatives (P01AB)

1. Metronidazole (P01AB01)*
2. Tinidazole (P01AB02)*
3. Ornidazole (P01AB03)
4. Azanidazole (P01AB04)
5. Propenidazole (P01AB05)
6. Nimorazole (P01AB06)
7. Secnidazole (P01AB07)
8. Metronidazole, combinations (P01AB51)

Note:

[1] Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

Table 27: List of antimicrobials under WHO ATC pharmacological subgroup Intestinal Antiinfectives (A07A)

Antibiotics (A07AA)	
1. Neomycin (A07AA01)	8. Kanamycin (A07AA08)
2. Nystatin (A07AA02)	9. Vancomycin (A07AA09)*
3. Natamycin (A07AA03)	10. Colistin (A07AA10)
4. Streptomycin (A07AA04)	11. Rifaximin (A07AA11)*
5. Polymyxin B (A07AA05)	12. Fidaxomicin (A07AA12)
6. Paromomycin (A07AA06)	13. Neomycin, combinations (A07AA51)
7. Amphotericin B (A07AA07)	14. Streptomycin, combinations (A07AA54)

Note:

[1] For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

6.2 Total antimicrobial dispensed in HA non-inpatient service, stratified by service type

6.2.1 Total antimicrobial dispensed in HA non-inpatient service, stratified by service type and WHO ATC Pharmacological Subgroup

Table 28: Total antimicrobial dispensed in Primary care, in terms of DDD per 1,000 attendances, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 attendances			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01C	Beta-Lactam Antibacterials, Penicillins	167.70	182.26	192.98	15.08%
J01F	Macrolides, Lincosamides and Streptogramins	16.41	17.68	20.93	27.58%
J01A	Tetracyclines	17.29	16.40	15.70	-9.21%
J01X	Other Antibacterials	16.73	15.46	14.90	-10.98%
J01M	Quinolone Antibacterials	5.86	6.46	7.66	30.81%
P01A‡	Agents against amoebiasis and other protozoal diseases	3.17	3.22	3.16	-0.18%
J01D	Other Beta-Lactam Antibacterials	2.09	2.68	2.88	38.27%
J01E	Sulfonamides and Trimethoprim	2.94	2.35	2.46	-16.24%
J01G	Aminoglycoside Antibacterials	§	-	§	232.85%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

‡ Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

§ Less than 0.005

Table 29: Total antimicrobial dispensed in Specialist Out-patient (Clinical), in terms of DDD per 1,000 attendances, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 attendances			
Code	Description	Year 2014[*]	Year 2015[*]	Year 2016[*]	Percentage change (2014 vs 2016)[*†]
J01C	Beta-Lactam Antibacterials, Penicillins	102.56	101.26	104.82	2.21%
J01F	Macrolides, Lincosamides and Streptogramins	52.71	48.63	50.48	-4.23%
J01A	Tetracyclines	20.94	28.71	31.33	49.62%
J01M	Quinolone Antibacterials	28.78	28.75	28.01	-2.69%
J01E	Sulfonamides and Trimethoprim	14.86	14.97	15.30	2.96%
J01D	Other Beta-Lactam Antibacterials	8.99	8.48	8.07	-10.28%
J01X	Other Antibacterials	4.82	4.92	5.55	15.15%
A07A[¶**]	Intestinal Antiinfectives	1.71	3.45	4.37	156.28%
P01A[‡]	Agents against amoebiasis and other protozoal diseases	3.60	3.61	3.82	6.21%
J01G	Aminoglycoside Antibacterials	0.28	0.27	0.20	-30.55%

[*] Rounded to two decimal places

[†] Due to rounding, percentages may not precisely reflect the absolute figures

[‡] Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

[§] Less than 0.005

[¶] For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

[**] High percentage change in Intestinal Antiinfectives (A07A) is estimated due to relatively small amount of antimicrobial dispensed in year 2014

Table 30: Total antimicrobial dispensed in Accident & Emergency, in terms of DDD per 1,000 attendances, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 attendances			
Code	Description	Year 2014[*]	Year 2015[*]	Year 2016[*]	Percentage change (2014 vs 2016)[*†]
J01C	Beta-Lactam Antibacterials, Penicillins	561.44	594.11	599.35	6.75%
J01M	Quinolone Antibacterials	44.17	46.90	43.50	-1.52%
J01F	Macrolides, Lincosamides and Streptogramins	33.83	33.10	34.99	3.42%
J01X	Other Antibacterials	28.88	27.29	29.14	0.87%
J01D	Other Beta-Lactam Antibacterials	19.28	15.85	12.31	-36.12%
J01A	Tetracyclines	8.45	9.45	11.43	35.27%
P01A[‡]	Agents against amoebiasis and other protozoal diseases	6.70	6.27	5.65	-15.77%
J01E	Sulfonamides and Trimethoprim	4.08	2.19	1.74	-57.29%
J01G	Aminoglycoside Antibacterials	0.04	0.02	0.05	20.87%
A07A[¶**]	Intestinal Antiinfectives	§	§	0.01	11,463.64%

[*] Rounded to two decimal places

[†] Due to rounding, percentages may not precisely reflect the absolute figures

[‡] Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

[§] Less than 0.005

[¶] For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

[**] High percentage change in Intestinal Antiinfectives (A07A) is estimated due to relatively small amount of antimicrobial dispensed in year 2014

6.2.2 Ten most dispensed antimicrobials in HA non-inpatient service, stratified by service type

Table 31: Ten most dispensed antimicrobials, in terms of DDD per 1,000 attendances, in Primary care

ATC Chemical Substance		DDD per 1,000 attendances			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	75.02	98.10	114.54	52.68%
J01CA04	Amoxicillin	34.49	30.14	29.21	-15.32%
J01CF02	Cloxacillin	32.91	30.65	27.31	-17.03%
J01CA01	Ampicillin	21.41	19.83	17.76	-17.01%
J01FA09	Clarithromycin	11.35	12.54	15.76	38.90%
J01XE01	Nitrofurantoin	16.73	15.46	14.89	-10.99%
J01AA02	Doxycycline	11.78	12.13	12.64	7.35%
J01MA02	Ciprofloxacin	4.11	4.45	4.69	14.19%
J01CE02	Phenoxymethylpenicillin	3.87	3.54	4.16	7.68%
J01FA01	Erythromycin	3.04	3.19	3.28	7.85%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

Table 32: Ten most dispensed antimicrobials, in terms of DDD per 1,000 attendances, in Specialist Out-patient (Clinical)

ATC Chemical Substance		DDD per 1,000 attendances			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	64.30	66.12	71.97	11.92%
J01FA09	Clarithromycin	36.66	32.26	33.09	-9.73%
J01AA02	Doxycycline	17.65	24.78	27.03	53.14%
J01MA12	Levofloxacin	20.49	20.71	20.57	0.39%
J01CA04	Amoxicillin	19.90	19.02	18.58	-6.65%
J01EE01	Sulfamethoxazole/ Trimethoprim	14.06	14.28	14.69	4.48%
J01FA10	Azithromycin	8.22	8.59	9.74	18.48%
J01MA02	Ciprofloxacin	7.30	7.27	6.66	-8.80%
J01CF02	Cloxacillin	8.65	7.47	6.48	-25.13%
J01DC02	Cefuroxime	6.98	6.48	6.07	-13.14%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

Table 33: Ten most dispensed antimicrobials, in terms of DDD per 1,000 attendances, in Accident & Emergency

ATC Chemical Substance		DDD per 1,000 attendances			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	435.05	489.61	508.78	16.95%
J01CF02	Cloxacillin	54.99	46.00	38.65	-29.72%
J01CA01	Ampicillin	48.66	39.77	33.84	-30.46%
J01XE01	Nitrofurantoin	28.76	27.20	29.05	1.02%
J01MA02	Ciprofloxacin	26.31	27.11	23.70	-9.93%
J01FA09	Clarithromycin	20.49	20.06	20.51	0.07%
J01MA12	Levofloxacin	17.81	19.74	19.75	10.91%
J01CA04	Amoxicillin	18.29	14.92	13.82	-24.41%
J01AA02	Doxycycline	8.03	9.12	11.00	37.02%
J01FA10	Azithromycin	9.55	10.15	10.92	14.35%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

6.3 Total antimicrobial dispensed in HA inpatient service, stratified by specialties

6.3.1 Total antimicrobial dispensed in HA inpatient service, stratified by specialties and WHO ATC Pharmacological Subgroup

Table 34: Total antimicrobial dispensed in Medicine, in terms of DDD per 1,000 patient-days, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01C	Beta-Lactam Antibacterials, Penicillins	727.73	751.15	753.00	3.47%
J01D	Other Beta-Lactam Antibacterials	110.26	113.12	111.03	0.71%
J01M	Quinolone Antibacterials	111.88	111.37	105.27	-5.91%
J01F	Macrolides, Lincosamides and Streptogramins	83.35	71.59	66.00	-20.82%
J01A	Tetracyclines	34.62	43.23	60.52	74.81%
J01X	Other Antibacterials	26.75	27.56	25.92	-3.10%
J01E	Sulfonamides and Trimethoprim	13.04	13.16	13.14	0.74%
J01G	Aminoglycoside Antibacterials	9.52	9.57	8.72	-8.36%
P01A‡	Agents against amoebiasis and other protozoal diseases	8.32	8.22	7.63	-8.28%
A07A¶**	Intestinal Antiinfectives	1.21	2.26	4.33	258.34%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

‡ Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

§ For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

¶ High percentage change in Intestinal Antiinfectives (A07A) is estimated due to relatively small amount of antimicrobial dispensed in year 2014

Table 35: Total antimicrobial dispensed in Surgery, in terms of DDD per 1,000 patient-days, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 patient-days			
Code	Description	Year 2014[*]	Year 2015[*]	Year 2016[*]	Percentage change (2014 vs 2016)[*†]
J01C	Beta-Lactam Antibacterials, Penicillins	793.51	886.82	937.27	18.12%
J01D	Other Beta-Lactam Antibacterials	267.42	227.22	194.98	-27.09%
J01M	Quinolone Antibacterials	139.03	144.44	139.50	0.34%
J01X	Other Antibacterials	94.32	83.38	65.95	-30.08%
J01F	Macrolides, Lincosamides and Streptogramins	49.56	45.93	46.17	-6.85%
P01A[‡]	Agents against amoebiasis and other protozoal diseases	50.94	48.27	42.35	-16.86%
J01A	Tetracyclines	16.55	16.29	19.37	17.02%
J01G	Aminoglycoside Antibacterials	10.34	10.82	9.99	-3.36%
J01E	Sulfonamides and Trimethoprim	7.43	8.28	7.11	-4.22%
A07A[¶**]	Intestinal Antiinfectives	7.18	10.60	6.75	-5.97%

[*] Rounded to two decimal places

[†] Due to rounding, percentages may not precisely reflect the absolute figures

[‡] Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

[§] For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

[¶] High percentage change in Intestinal Antiinfectives (A07A) is estimated due to relatively small amount of antimicrobial dispensed in year 2014

Table 36: Total antimicrobial dispensed in Orthopedics and Traumatology, in terms of DDD per 1,000 patient-days, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 patient-days			
Code	Description	Year 2014[*]	Year 2015[*]	Year 2016[*]	Percentage change (2014 vs 2016)[*†]
J01C	Beta-Lactam Antibacterials, Penicillins	765.99	762.84	729.10	-4.82%
J01D	Other Beta-Lactam Antibacterials	98.99	101.39	102.04	3.08%
J01M	Quinolone Antibacterials	87.90	89.95	93.72	6.61%
J01X	Other Antibacterials	41.90	39.32	43.99	5.00%
J01F	Macrolides, Lincosamides and Streptogramins	22.60	22.65	21.51	-4.80%
J01A	Tetracyclines	6.88	7.69	10.19	48.13%
J01E	Sulfonamides and Trimethoprim	10.47	8.89	8.97	-14.40%
J01G	Aminoglycoside Antibacterials	5.52	6.22	5.19	-6.04%
P01A[‡]	Agents against amoebiasis and other protozoal diseases	4.61	4.22	4.00	-13.11%
A07A[¶**]	Intestinal Antiinfectives	0.07	0.11	1.24	1671.48%

[*] Rounded to two decimal places

[†] Due to rounding, percentages may not precisely reflect the absolute figures

[‡] Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

[§] For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

[¶] High percentage change in Intestinal Antiinfectives (A07A) is estimated due to relatively small amount of antimicrobial dispensed in year 2014

Table 37: Total antimicrobial dispensed in ICU/ HDU, in terms of DDD per 1,000 patient-days, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 patient-days			
Code	Description	Year 2014[*]	Year 2015[*]	Year 2016[*]	Percentage change (2014 vs 2016)[*†]
J01C	Beta-Lactam Antibacterials, Penicillins	607.56	572.86	586.04	-3.54%
J01D	Other Beta-Lactam Antibacterials	429.73	390.03	418.74	-2.56%
J01X	Other Antibacterials	305.16	270.09	284.06	-6.91%
J01M	Quinolone Antibacterials	162.59	162.31	169.20	4.06%
J01A	Tetracyclines	106.59	116.24	148.69	39.50%
J01F	Macrolides, Lincosamides and Streptogramins	129.09	109.31	112.11	-13.15%
J01E	Sulfonamides and Trimethoprim	39.50	49.21	53.21	34.70%
J01G	Aminoglycoside Antibacterials	34.84	41.66	44.26	27.05%
A07A[¶**]	Intestinal Antiinfectives	7.62	9.50	12.99	70.43%
P01A[‡]	Agents against amoebiasis and other protozoal diseases	12.70	11.26	12.10	-4.72%

[*] Rounded to two decimal places

[†] Due to rounding, percentages may not precisely reflect the absolute figures

[‡] Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

[§] For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

[¶] High percentage change in Intestinal Antiinfectives (A07A) is estimated due to relatively small amount of antimicrobial dispensed in year 2014

Table 38: Total antimicrobial dispensed in Others, in terms of DDD per 1,000 patient-days, stratified by WHO ATC Pharmacological Subgroup

ATC Pharmacological Subgroup		DDD per 1,000 patient-days			
Code	Description	Year 2014[*]	Year 2015[*]	Year 2016[*]	Percentage change (2014 vs 2016)[*†]
J01C	Beta-Lactam Antibacterials, Penicillins	392.22	407.30	445.12	13.49%
J01D	Other Beta-Lactam Antibacterials	98.28	89.15	87.95	-10.50%
J01M	Quinolone Antibacterials	49.07	50.44	49.31	0.50%
J01F	Macrolides, Lincosamides and Streptogramins	33.06	30.49	42.30	27.92%
J01X	Other Antibacterials	29.60	29.91	27.74	-6.31%
J01A	Tetracyclines	22.56	21.20	24.94	10.55%
P01A[‡]	Agents against amoebiasis and other protozoal diseases	21.33	18.78	18.63	-12.63%
J01E	Sulfonamides and Trimethoprim	11.07	10.75	10.49	-5.31%
J01G	Aminoglycoside Antibacterials	11.41	10.55	8.84	-22.53%
A07A[¶**]	Intestinal Antiinfectives	0.12	0.18	0.47	303.14%

[*] Rounded to two decimal places

[†] Due to rounding, percentages may not precisely reflect the absolute figures

[‡] Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

[§] For Intestinal Antiinfectives (A07A), only drugs belonging to Anibiotics (A07AA) under this group is included

[¶] High percentage change in Intestinal Antiinfectives (A07A) is estimated due to relatively small amount of antimicrobial dispensed in year 2014

6.3.2 Ten most dispensed antimicrobials in HA inpatient service, stratified by specialties

Table 39: Ten most dispensed antimicrobials, in terms of DDD per 1,000 patient-days, in Medicine

ATC Chemical Substance		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	607.63	631.10	633.90	4.32%
J01MA12	Levofloxacin	92.30	90.79	85.62	-7.24%
J01CR05	Piperacillin/ Tazobactam	54.75	67.29	72.10	31.68%
J01AA02	Doxycycline	33.22	41.44	58.57	76.32%
J01DH02	Meropenem	25.26	30.65	32.58	29.00%
J01FA10	Azithromycin	29.64	29.34	32.49	9.62%
J01DD04	Ceftriaxone	33.36	31.25	32.10	-3.80%
J01FA09	Clarithromycin	48.50	37.69	28.63	-40.97%
J01CF02	Cloxacillin	27.42	23.15	20.00	-27.08%
J01MA02	Ciprofloxacin	17.81	18.25	17.06	-4.22%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

Table 40: Ten most dispensed antimicrobials, in terms of DDD per 1,000 patient-days, in Surgery

ATC Chemical Substance		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	655.05	757.85	817.29	24.77%
J01DC02	Cefuroxime	212.27	164.05	126.66	-40.33%
J01MA12	Levofloxacin	104.16	111.95	109.46	5.09%
J01CR05	Piperacillin/ Tazobactam	33.59	39.76	43.79	30.35%
P01AB01	Metronidazole	50.94	48.27	42.35	-16.86%
J01FA09	Clarithromycin	45.34	41.15	40.17	-11.41%
J01XD01	Metronidazole	70.79	59.39	39.41	-44.32%
J01CA04	Amoxicillin	42.48	38.73	38.76	-8.76%
J01DH02	Meropenem	21.02	27.01	31.37	49.26%
J01MA02	Ciprofloxacin	34.03	31.57	29.20	-14.21%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

‡ Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

Table 41: Ten most dispensed antimicrobials, in terms of DDD per 1,000 patient-days, in Orthopedics and Traumatology

ATC Chemical Substance		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	394.27	456.86	519.92	31.87%
J01CF02	Cloxacillin	198.29	164.34	109.37	-44.84%
J01MA12	Levofloxacin	65.23	65.34	72.02	10.40%
J01CA01	Ampicillin	143.16	110.22	64.46	-54.97%
J01DB04	Cefazolin	41.36	42.41	43.67	5.59%
J01XA01	Vancomycin	16.50	17.56	21.82	32.24%
J01MA02	Ciprofloxacin	21.50	23.84	21.30	-0.90%
J01DC02	Cefuroxime	27.61	25.06	20.80	-24.65%
J01CR05	Piperacillin/ Tazobactam	12.30	15.87	18.58	51.13%
J01DD04	Ceftriaxone	15.26	15.08	18.43	20.80%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

Table 42: Ten most dispensed antimicrobials, in terms of DDD per 1,000 patient-days, in ICU/ HDU

ATC Chemical Substance		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	261.00	257.57	241.80	-7.36%
J01CR05	Piperacillin/ Tazobactam	209.09	203.34	202.88	-2.97%
J01DH02	Meropenem	176.52	167.44	174.29	-1.26%
J01MA12	Levofloxacin	143.31	145.18	148.98	3.95%
J01AA02	Doxycycline	73.77	86.92	121.36	64.52%
J01XD01	Metronidazole	111.86	110.17	110.11	-1.56%
J01DD04	Ceftriaxone	109.35	83.69	95.68	-12.49%
J01XA01	Vancomycin	80.58	74.10	90.62	12.46%
J01CF02	Cloxacillin	51.29	50.22	68.09	32.74%
J01FA10	Azithromycin	46.35	49.09	61.15	31.91%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

Table 43: Ten most dispensed antimicrobials, in terms of DDD per 1,000 patient-days, in Others

ATC Chemical Substance		DDD per 1,000 patient-days			
Code	Description	Year 2014*	Year 2015*	Year 2016*	Percentage change (2014 vs 2016)*†
J01CR02	Amoxicillin/ Clavulanate	274.27	301.25	345.35	25.92%
J01MA12	Levofloxacin	33.07	33.25	34.84	5.33%
J01DC02	Cefuroxime	47.04	36.51	33.05	-29.75%
J01CA01	Ampicillin	39.15	33.31	28.84	-26.33%
J01FA09	Clarithromycin	21.52	18.48	27.05	25.70%
J01AA02	Doxycycline	21.69	20.05	23.53	8.50%
J01CR05	Piperacillin/ Tazobactam	17.47	19.90	21.06	20.60%
J01CF02	Cloxacillin	24.48	22.39	18.82	-23.14%
P01AB01	Metronidazole	21.33	18.78	18.63	-12.63%
J01DD04	Ceftriaxone	16.42	16.58	17.35	5.62%

* Rounded to two decimal places

† Due to rounding, percentages may not precisely reflect the absolute figures

‡ Only drugs belonging to Nitroimidazole Derivatives (P01AB) under Agents against amoebiasis and other protozoal diseases (P01A) are included

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List of Abbreviations

AMR Antimicrobial Resistance

AMU Antimicrobial Use

ATC Anatomical Therapeutic Chemical

DDD Defined Daily Dose

DH Department of Health

HA Hospital Authority

ICU/ HDU Intensive Care Unit/ High Dependency Unit

WHO World Health Organization

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