

5.

Antimicrobial consumption in humans

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Highlights

Antimicrobial consumption in Denmark has been monitored in DANMAP since 1996. During the initial years of surveillance, the consumption was estimated to be 13-14 DDD per 1000 inhabitants per day (DID). From 2001 consumption increased markedly and continuously, reaching its peak of 18,90 DID in 2011, an increase of more than 30%. Since 2011 consumption has decreased again. In 2025, antimicrobial consumption was 15.35 DID, 12.4% lower than consumption in 2016 (17.53 DID) and 6% lower than in 2024 (16.27 DID). Use of the AWaRe classification of antimicrobials on consumption in Denmark shows that 82% in 2025 consisted of access antimicrobials (WHO´s goal is minimum 60% access antimicrobials).

In primary health care, total antimicrobial consumption was 13.48 DID in 2025, 6% lower than in 2024 (14.35 DID) and 14% lower than in 2016 (15.67 DID). The four groups of penicillins constituted 65% of the total antimicrobial consumption and beta-lactama sesensitive penicillins were the most used antimicrobials (accounting for 24% of total consumption in primary health care).

Antimicrobials prescribed for children decreased in 2025: among the 0–4-year-olds, consumption was on average 203 treated patients per 1,000 inhabitants, a 12% decrease compared to 230 in 2024. For the 5–9-year-olds, 118 patients per 1,000 inhabitants were treated in 2025 compared to 172 in 2024 (32% decrease). The years 2022 and 2023 had seen severe and prolonged outbreaks of both Group A streptococci and *Mycoplasma pneumoniae* infections in children, as well as high rates of viral infections, in particular early and more severe RSV and influenza seasons. The decrease in consumption in 2024 and 2025 highlights a return to lower rates of respiratory infections.

Older inhabitants living in care homes during 2025 continued to receive notably more antimicrobials than older inhabitants living in their own homes. Urinary tract infections were the main indication driving the high treatment frequency at care homes (991 versus 433 prescriptions for urinary tract infections per 1,000 older inhabitants, respectively, in 2025).

Antimicrobial consumption in hospital care was 1.87 DID in 2025. When accounting for hospital activity, the consumption in 2025 was 144.7 DDD per 100 bed-days (DBD) and 540.7 DDD per 100 admissions (DAD), similar to the consumption in 2024. However, consumption of combinations of penicillins, including beta-lactamase inhibitors, decreased since 2024 (4-5% in 2025) after several years of increasing consumption. Over the decade, the overall hospital consumption at acute care hospitals has increased by 56% and 23%, when measured in DBD and DAD, respectively.

5.1 Introduction

In Denmark, antimicrobials are available by prescription from medical doctors, veterinarians and dentists. Sale is restricted to licensed pharmacies that have exclusive rights to sell medicine on prescription. No over-the-counter sale takes place. All consumption of medicinal products for humans is recorded through the Register of Medicinal Product Statistics at the Danish Health Data Authority (see Figure 2.1). This includes sales data from all public and private healthcare providers. Antimicrobial sales data have been submitted from the primary care sector since 1994 and from the hospital sector since 1997.

Registration of medicine consumption in the primary care sector covers sales from pharmacies to individuals and private clinics. Sales data contain an identifier of the prescriber and the patient in addition to information about the prescribed antimicrobial. This includes the ATC code, formulation, package size and number of packages sold. Since 2004, the Register of Medicinal Product Statistics also receives information about the indication on prescriptions. This allows a very detailed and near-complete surveillance of all systemic antimicrobials used in Denmark in primary health care.

For the hospital sector, antimicrobial consumption data from all public somatic hospitals with an acute care function (referred to as somatic hospitals) are included in the report. Data from psychiatric hospitals, private hospitals and hospices are excluded, since they only account for a minor share of antimicrobial consumption and no reliable denominator for measuring antimicrobial consumption in these facilities is available.

In this chapter, the term 'antimicrobials' covers all systemic antibacterial agents for human use listed in the Anatomical Therapeutic Chemical (ATC) Classification under the code J01. Metronidazole (ATC code P01AB01) and for hospitals vancomycin (ATC code A07AA09) have been included since 2014. Consumption of tuberculostatica, antifungal drugs and antivirals are not included.

The Danish Healthcare system has undergone changes in recent years, which has led to functions being reassigned from hospitals to ambulatory care and further on to smaller health units, rehabilitation centers and general practice. Based on the recommendations from The Danish Resilience Commission, September 2023, future changes will include the establishment of regional and local health councils and the merger of the Capital Region and Region Zealand as from January 2027. In addition, psychiatry will administratively be placed together with the somatic functions, which means that data and registers from these functions are expected to also be merged in the future. Such changes in organization may impact consumption trends per healthcare sector but may also demand rethinking of commonly used denominators such as DDD per bed-day or per admission.

For over 30 years, larger Danish hospitals have driven diagnostically anchored antimicrobial stewardship (AMS) through their Departments of Clinical Microbiology. In recent years, this framework has expanded via infectious disease specialists enrolling in AMS training programs and establishing dedicated AMS teams across clinical wards.

In 2017, the Danish Regions developed criteria on better use of critically important antibiotics via the Danish Learning and Quality Teams. This led to the establishment of antibiotic committees locally and across the Regions.

Concurrently, primary care initiatives have been supported by the Danish Research Center for General Medicine and the Association of General Practitioners.

The new Danish National Action Plan against antimicrobial resistance in humans from June 2025 aims to further strengthen the work. The action plan is monitored in the separate publication "Perspectives of DANMAP 2025".

5.2 Total antimicrobial consumption in the Danish healthcare system

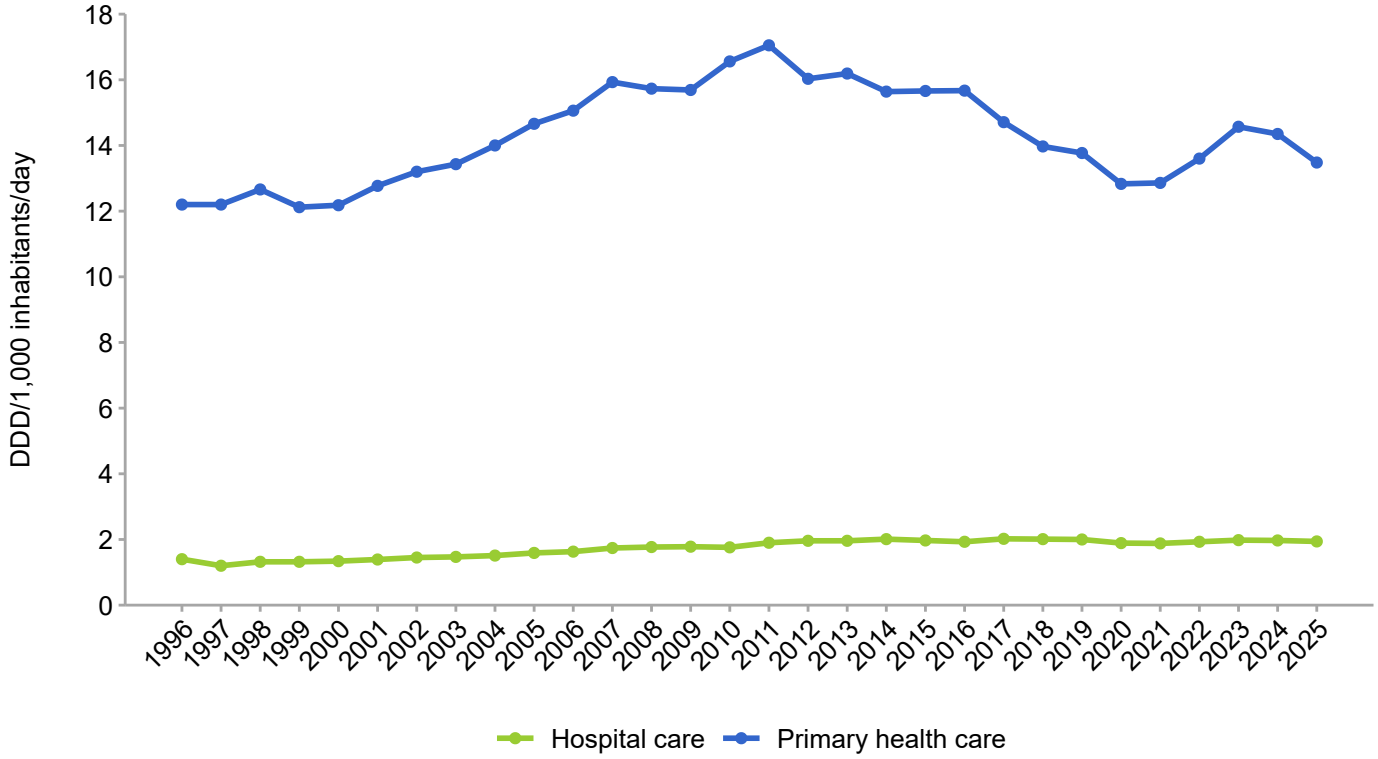
During the first five years of surveillance from 1996 to 2000, the consumption of systemic antimicrobials in Denmark showed no significant changes and consumption was estimated to be 13 to 14 Defined Daily Doses per 1,000 inhabitants per day (DID), (Figure 5.1). Data are not fully comparable to later years' reporting due to changes in data collection and systems.

From 2001 to 2011, consumption increased steadily and peaked at a total of 18.95 DID (34%). From 2011 to 2025, consumption decreased overall (-19% compared to 2011), albeit with more fluctuations, the most notable being a marked drop during the COVID-19 pandemic, followed by an equally marked resurgence during 2022 and 2023. The observed decreases were driven by reduced prescribing in primary care, which accounts for 88% of antibiotic consumption in Denmark (Figure 5.2).

For comparison, antimicrobial consumption at hospitals fluctuated more, moving between the highest level of 1.95 DID in 2017 and the lowest level of 1.81 DID in 2021. The notably lower consumption in 2020 and 2021 is considered an exception due to the COVID-19 pandemic.

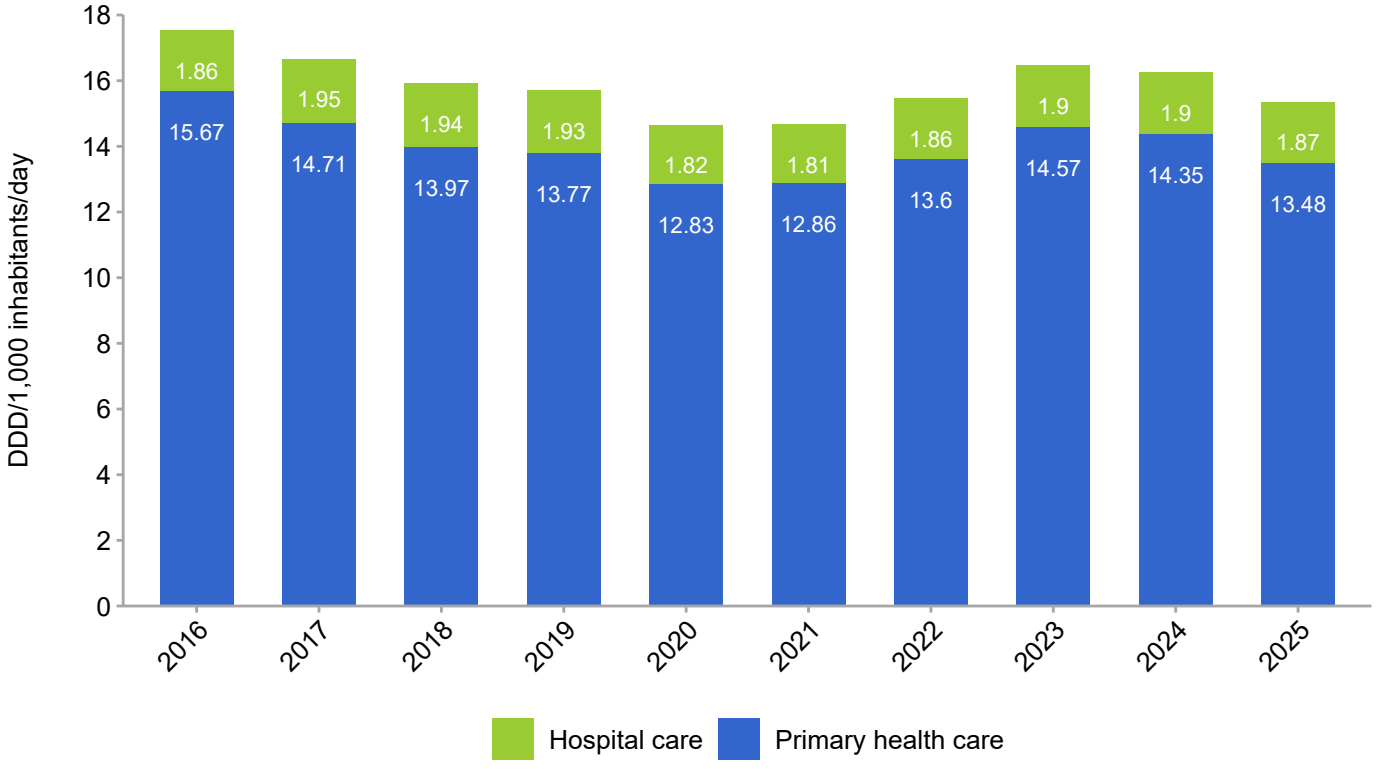
The total consumption of antimicrobials in primary health care and at somatic hospitals in the five Danish health regions is presented in Figure 5.3. The trends in consumption are similar for all five regions. Region Zealand showed the highest total consumption of 16.12 DID in 2025, whereas the Central Region of Denmark had the lowest total consumption of 13.67 DID. Figure 5.4 presents the drug classes used in primary health care and at hospitals; both sectors show a high share of penicillins in their usage patterns. Broad-spectrum antibiotics, such as cephalosporins, aminoglycosides and carbapenems, are predominantly used in hospitals. Assessed by WHO's Access, Watch and Reserve (AWaRe) classification system, "access antimicrobials" have constituted at least 80% since 2014 and constituted 82% in 2025.

Figure 5.1 Antimicrobial agents in Danish healthcare system, DDD per 1,000 inhabitants per day, Denmark, 1996-2025 DANMAP 2025



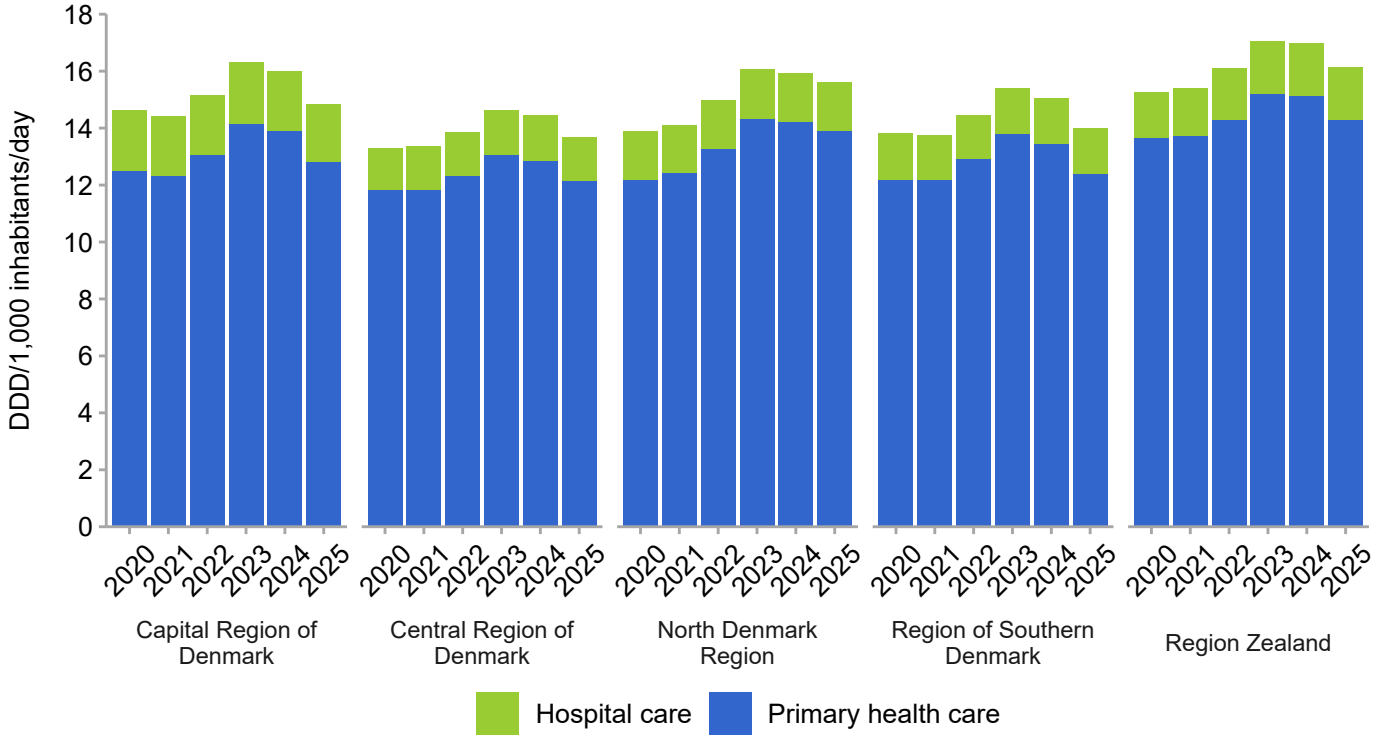
Data: Sales of antimicrobials in Denmark.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Figure 5.2 Total consumption of systemic antimicrobial agents in humans per health care sector, DDD per 1,000 inhabitants per day, Denmark, 2016-2025 DANMAP 2025



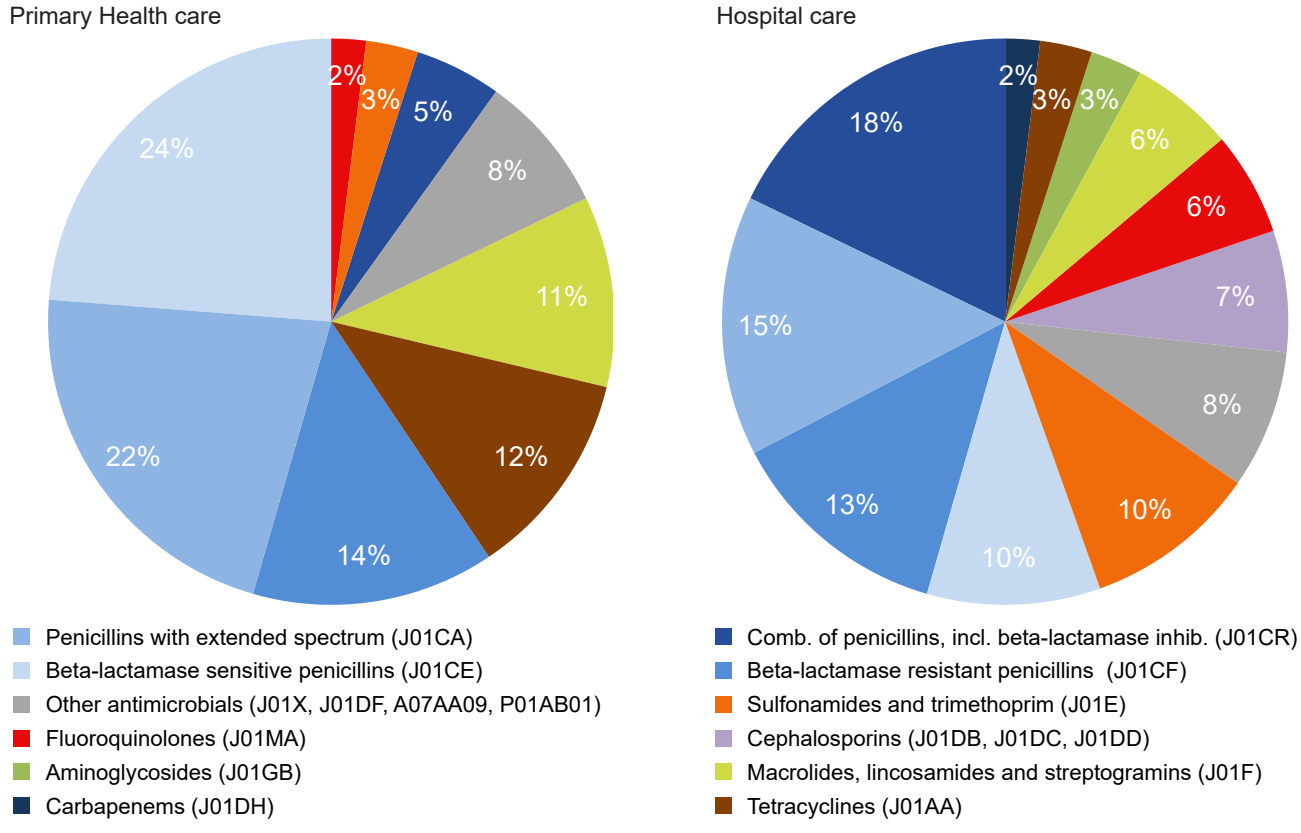
Data: Sales of antimicrobials in Denmark.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Figure 5.3 Consumption of systemic antimicrobial agents in primary health care and somatic hospitals, DDD per 1,000 inhabitants per day, Danish regions, 2020-2025
DANMAP 2025



Data: Registered sales of antimicrobials to individuals and to somatic hospital departments.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Figure 5.4 Percentage distribution of antimicrobial agent groups in primary health care and hospital care, DDD, Denmark, 2025
DANMAP 2025



Data: Registered sales of antimicrobials to individuals and to somatic hospital departments.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

5.3 Antimicrobial consumption in primary health care

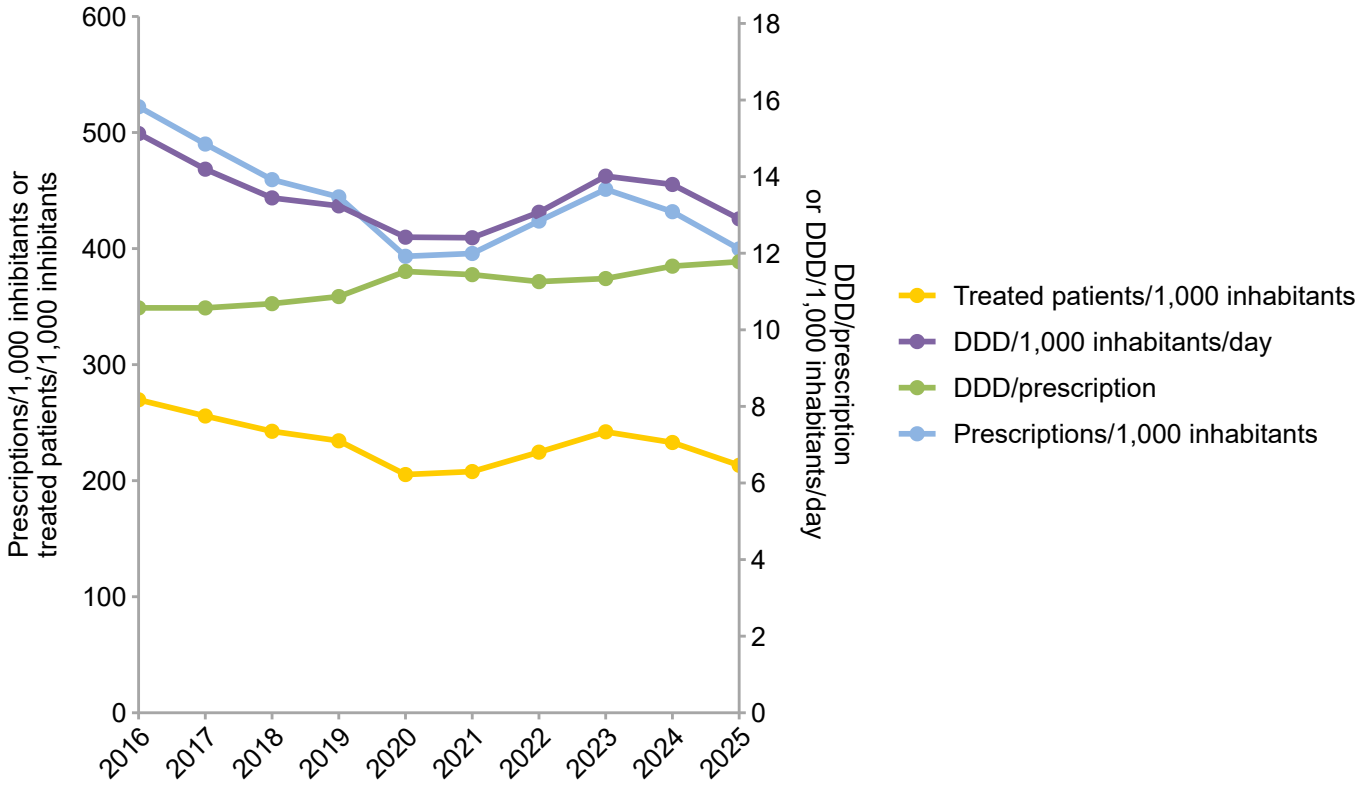
In the following sections, the consumption of antimicrobials in primary health care is described by the units DDD per 1,000 inhabitants per day, number of prescriptions per 1,000 inhabitants and number of treated patients per 1,000 inhabitants. Data are based on sales to individuals and do not include the approximately 4% of antimicrobials, mainly penicillins, sold to clinics and doctors on call (out-of-hours service).

5.3.1 Overall antimicrobial consumption in primary health care

Comparison of trends over time by different indicators showed decreases in the number of treated patients and issued prescriptions from 2014-2020, no change from 2020-2021 and increased consumption from 2021-2023 (Figure 5.5). In 2025, an average of 213 patients per 1,000 inhabitants were treated and 400 prescriptions per 1,000 inhabitants were issued (7-8% lower than in 2024). The number of DDD per 1,000 inhabitants was 12.90 (6.5% lower than in 2024).

A decade earlier, in 2016, the number of treated patients per 1,000 inhabitants was 270, the number of prescriptions per 1,000 inhabitants was 522, and the number of DDD per 1,000 inhabitants was 15.13 (Table 5.1, Table 5.2 and Table 5.3). The change in the number of treated patients and issued prescriptions over the decade corresponds to a 21% and a 24% decrease, respectively. However, doses per prescription have increased, primarily due to a switch to antibiotics that contribute with more DDDs per treatment, e.g., the switch to pivmecillinam as the drug of choice for the treatment of urinary tract infections and the switch to tetracycline as the drug of choice for the treatment of chlamydia.

Figure 5.5 Consumption of systemic antimicrobial agents in primary health care, Denmark, 2016-2025 DANMAP 2025



Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Table 5.1 Consumption of antimicrobial agents for systemic use in primary health care, DDD per 1,000 inhabitants per day, Denmark, 2006 and 2016-2025

DANMAP 2025

ATC group	Therapeutic group	2006	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
J01CA	Penicillins with extended spectrum	2.55	3.33	3.36	3.35	3.28	3.19	3.17	3.26	3.28	3.05	2.96
J01CE	Beta-lactamase sensitive penicillins	5.41	4.16	3.88	3.61	3.44	2.84	2.89	3.23	3.96	3.49	3.20
J01CF	Beta-lactamase resistant penicillins	1.05	1.48	1.56	1.6	1.63	1.58	1.61	1.72	1.78	1.85	1.83
J01CR	Combinations of penicillins, including beta-lactamase inhibitors	0.08	0.95	0.79	0.66	0.63	0.52	0.55	0.63	0.71	0.74	0.65
J01D	Cephalosporins and other betalactam antibiotics	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
J01EA	Trimethoprim and derivates	0.47	0.56	0.56	0.53	0.45	0.43	0.42	0.39	0.41	0.35	0.34
J01EB	Short-acting sulfonamides	0.35	0.16	0.15	0.14	0.13	0.11	0.09	0.09	0.08	0.07	0.03
J01EE	Combination of sulfonamides and trimethoprim, including derivates	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01
J01FA	Macrolides	2.33	1.82	1.62	1.46	1.41	1.15	1.11	1.17	1.3	1.57	1.34
J01FF	Lincosamides	0.02	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.09	0.09
J01GB	Aminoglycosides	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
J01MA	Fluroquinolones	0.37	0.48	0.44	0.41	0.37	0.33	0.32	0.34	0.33	0.30	0.30
J01XC	Steroid antibacterials (combination fusidic acid)	0.01	0.01	0.01	0	0	0	0	0	0	0	0
J01XE	Nitrofuran derivates (nitrofurantoin)	0.47	0.43	0.26	0.15	0.27	0.27	0.28	0.27	0.12	0.19	0.22
J01XX	Other antibacterials (metheamine >99%)	0.27	0.27	0.28	0.29	0.32	0.34	0.39	0.43	0.47	0.55	0.64
J01AA	Tetracyclines	1.38	1.62	1.42	1.4	1.48	1.69	1.64	1.7	1.74	1.83	1.59
J01XD and P01AB01	Imidazole derivatives and metronidazole	0.22	0.28	0.25	0.24	0.24	0.23	0.24	0.24	0.25	0.21	0.24
J01 and P01AB01	All antimicrobial agents for systemic use	15.02	15.65	14.68	13.94	13.75	12.79	12.82	13.58	14.55	14.33	13.47

Data: Registered sales in primary health care.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Table 5.2 Number of treated patients per 1,000 inhabitants for leading antimicrobial agents in primary health care, Denmark, 2006 and 2016-2025

DANMAP 2025

ATC group	Therapeutic group	2006	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
J01AA	Tetracyclines	12.25	11.04	10.35	9.69	10.10	14.43	12.99	13.64	14.06	13.42	11.91
J01CA	Penicillins with extended spectrum	75.78	74.05	74.04	73.56	71.97	67.14	68.60	71.45	72.42	66.04	64.58
J01CE	Beta-lactamase sensitive penicillins	171.29	125.69	119.32	110.90	104.70	84.93	87.69	100.09	116.67	105.69	95.38
J01CF	Beta-lactamase resisistant penicillins	29.38	29.70	29.96	31.10	31.06	30.52	30.89	32.92	33.77	33.42	33.34
J01CR	Combinations of penicillins, incl. beta-lactamase inhibitors	2.27	22.17	19.89	17.73	17.33	14.43	15.50	17.90	20.28	21.16	19.70
J01E	Sulphonamides and trimethoprim	36.56	21.17	19.87	18.42	16.63	15.04	13.66	12.67	12.47	10.50	8.09
J01FA	Macrolides	67.03	53.21	46.01	40.11	38.45	25.13	24.97	27.16	30.06	38.55	27.72
J01MA	Fluoroquinolones	13.09	14.37	13.36	12.26	10.74	9.01	8.52	9.10	8.87	8.01	7.53
J01X	Other antibacterials (methenamine >99%)	7.70	7.47	5.01	3.62	5.66	5.80	5.95	5.91	2.65	5.17	6.05
P01AB01	Metronidazole	13.77	16.03	14.84	14.05	13.57	13.36	13.77	13.94	14.11	11.88	13.75
J01 and P01AB01	All antimicrobial agents for systemic use	313.4	269.7	255.7	242.6	234.3	205.3	207.9	224.6	242.1	232.9	213.3

Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Table 5.3 Number of prescriptions per 1,000 inhabitants for leading antimicrobial agents in primary health care, Denmark, 2006 and 2016-2025

DANMAP 2025

ATC group	Therapeutic group	2006	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
J01AA	Tetracyclines	20.63	17.18	15.89	14.63	15.11	20.19	18.25	18.71	19.11	17.84	15.13
J01CA	Penicillins with extended spectrum	111.39	113.16	114.37	114.31	112.19	105.93	107.97	112.19	114.05	103.92	101.86
J01CE	Beta-lactamase sensitive penicillins	226.74	157.13	148.52	136.81	128.77	104.07	107.28	122.87	145.45	129.57	116.51
J01CF	Beta-lactamase resisistant penicillins	41.36	41.87	41.87	43.35	43.16	42.87	43.17	45.66	47.05	46.42	46.44
J01CR	Combinations of penicillins, incl. beta-lactamase inhibitors	3.38	31.13	27.09	23.71	23.07	19.14	20.36	23.45	26.32	27.36	25.73
J01E	Sulphonamides and trimethoprim	56.68	36.41	34.29	31.74	28.14	25.59	23.07	21.26	21.30	18.31	14.10
J01FA	Macrolides	91.77	68.85	60.00	52.64	50.71	33.66	33.80	36.94	40.32	49.77	38.33
J01MA	Fluoroquinolones	17.11	18.74	17.37	15.97	13.99	12.07	11.41	11.96	11.57	10.48	10.00
J01X	Other antibacterials (methenamine >99%)	16.93	15.82	10.18	6.76	10.29	10.62	10.70	10.72	5.47	9.88	11.54
P01AB01	Metronidazole	16.13	18.63	17.26	16.31	15.78	15.62	16.00	16.17	16.25	13.55	15.83
J01 and P01AB01	All antimicrobial agents for systemic use	603.6	522.2	490.1	459.4	444.5	393.3	395.8	423.7	451.1	431.8	399.7

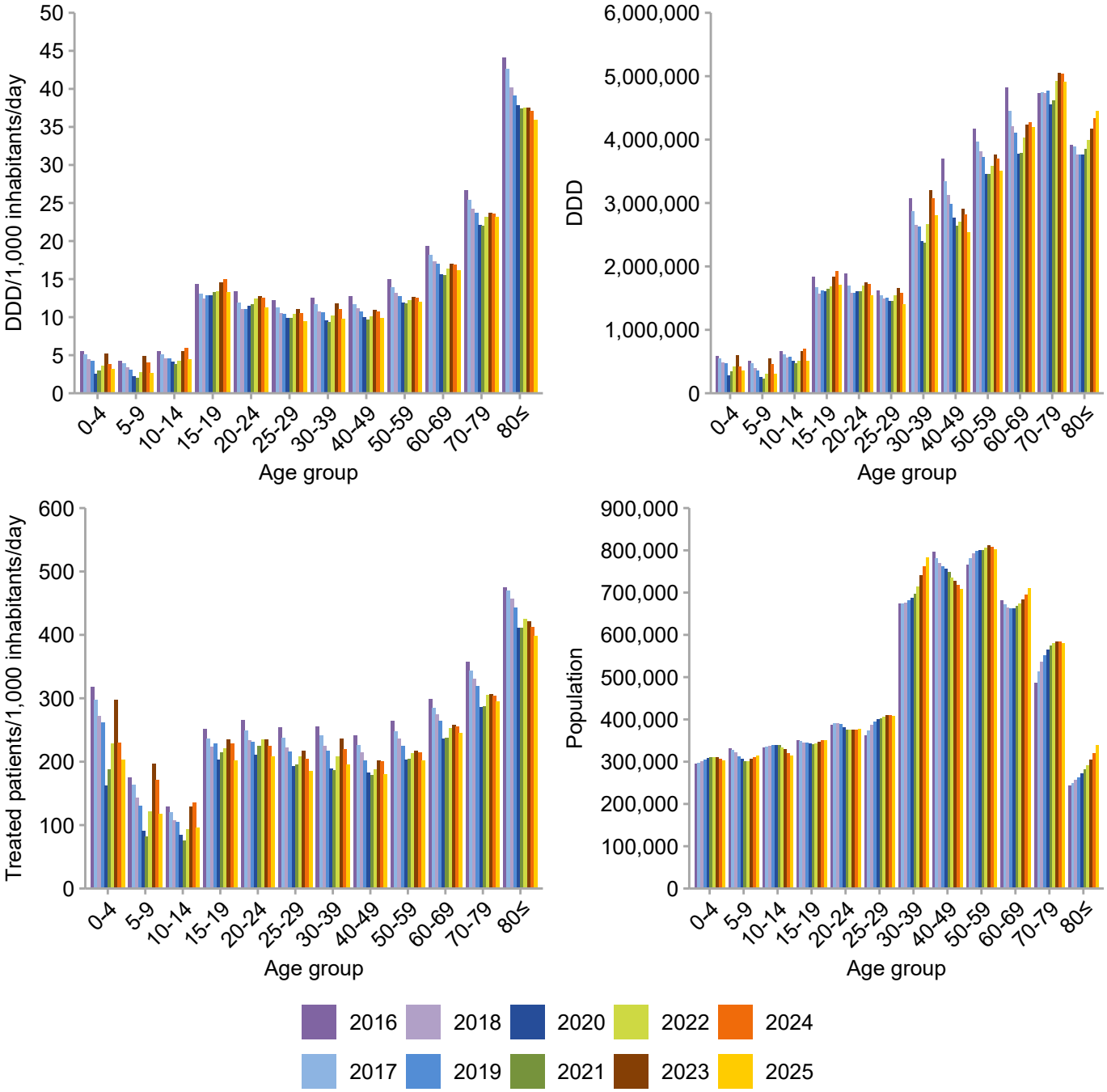
Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

5.3.2 Antimicrobial consumption by patient case mix

Antimicrobial consumption is highly affected by patient case mix. The need for antimicrobials differs throughout life and for the two genders. Antimicrobial consumption is also affected by sociodemographic factors such as civil status, educational level, employment status and country of birth (DANMAP 2022, Textbox 5.2). Figure 5.6a-c presents consumption of antimicrobials by age group based on different denominators: Figure 5.6a presents consumption in DDD per 1,000 inhabitants per day; Figure 5.6b in crude DDD, i.e., not corrected for population size; Figure 5.6c presents the number of patients treated per 1,000 inhabitants; Figure 5.6d presents population size by age group. Children and adolescents are presented in five-year age groups, while adults are clustered in 10-year age groups.

Estimates of antimicrobial consumption for children based on DDD should be interpreted with caution since the DDD is defined as "maintenance dose per day for its main indication in adults". The maintenance dose per day for children may differ from the one for adults due to different pharmacodynamics and -kinetics. Furthermore, infants and young children in the same age group might be treated with different doses based on body weight. Therefore, other units of measurement might be more suitable to monitor consumption in children, e.g., number of treated patients per 1,000 inhabitants and number of prescriptions per 1,000 inhabitants.

Figure 5.6 Consumption of systemic antimicrobial agents in primary health care by age group, measured in a) DDD per 1,000 inhabitants per day, b) DDD, c) treated patients per 1,000 inhabitants and d) population size, Denmark, 2016-2025 DANMAP 2025

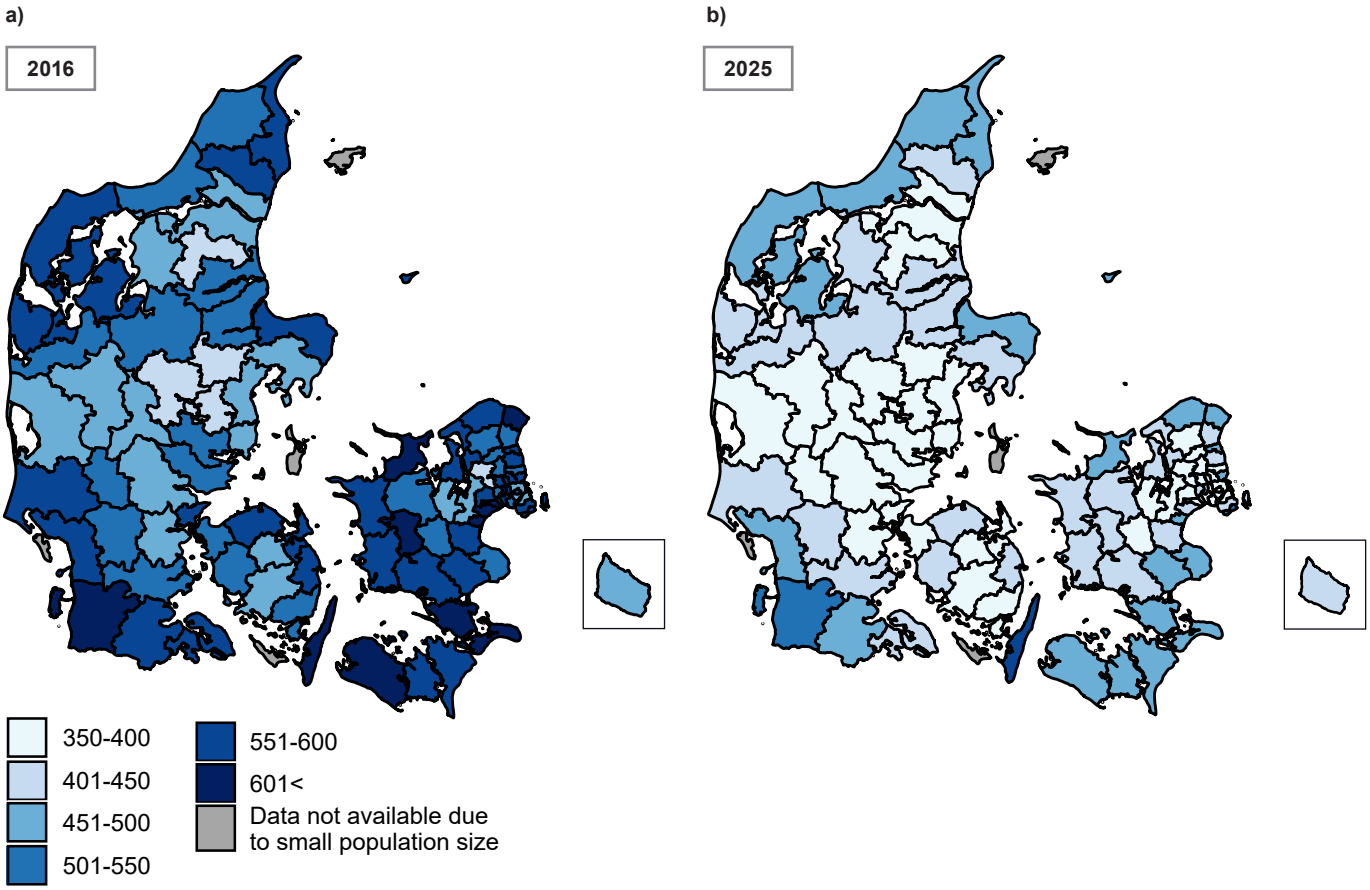


Children and adolescents are presented in five-year age groups, while adults are clustered in 10-year age groups.
Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics, the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and Statistics Denmark.

Interregional differences in the levels of prescribing have been described in DANMAP since 2017 (Table 5.4). In general, the Danish population is relatively homogeneous and health care is of standardized quality, which, combined with several initiatives to educate GPs in appropriate prescribing, diminishes potential differences in prescribing trends. However, observed variations in prescribing may owe to differences in population density (distance to the nearest general practitioner), differences in age and comorbidity of the population (younger populations in bigger cities and in the Capital Region) as well as behavioral differences between urban and rural populations.

Figure 5.7 Number of prescriptions in primary health care per 1,000 inhabitants in Danish municipalities in a) 2016 and b) 2025

DANMAP 2025



Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Figure 5.7 shows the number of prescriptions per 1,000 inhabitants at municipality level in 2016 and 2025, respectively. In 2025, the consumption ranged from 335 to 568 prescriptions per 1,000 inhabitants. In 2016, the range was 434-727 prescriptions per 1,000 inhabitants. 2016 was the baseline year for the first Danish action plan on reducing antimicrobial use in human health care (see Textbox 5.1 in DANMAP2021), whereas 2025 is the baseline year for the current national action plan, see Perspectives of DANMAP 2025. Of note is that prescribers in all regions reduced their prescribing activities in the shown period. Demographic differences might impact the range of prescribing. The distribution of older inhabitants over 60 across the municipalities closely follows that of prescriptions per 1,000 inhabitants with higher prescription rates in municipalities with larger populations of older inhabitants above 60 years (data not shown).

Table 5.4 Consumption of antimicrobial agents for systemic use in primary health care at regional level, Denmark, 2021-2025

DANMAP 2025

Region	Indicator	2021	2022	2023	2024	2025
Capital Region of Denmark	DDD/1.000 inhabitants/day	12.32	13.03	14.14	13.90	12.79
	Prescriptions/1.000 inhabitants	378	409	443	423	384
Central Region of Denmark	DDD/1.000 inhabitants/day	11.83	12.32	13.07	12.86	12.14
	Prescriptions/1.000 inhabitants	380	402	425	408	382
North Denmark Region	DDD/1.000 inhabitants/day	12.42	13.26	14.33	14.23	13.91
	Prescriptions/1.000 inhabitants	400	431	458	438	428
Region of Southern Denmark	DDD/1.000 inhabitants/day	12.17	12.91	13.78	13.43	12.37
	Prescriptions/1.000 inhabitants	405	434	460	440	402
Region Zealand	DDD/1.000 inhabitants/day	13.71	14.31	15.21	15.14	14.29
	Prescriptions/1.000 inhabitants	440	466	489	470	435

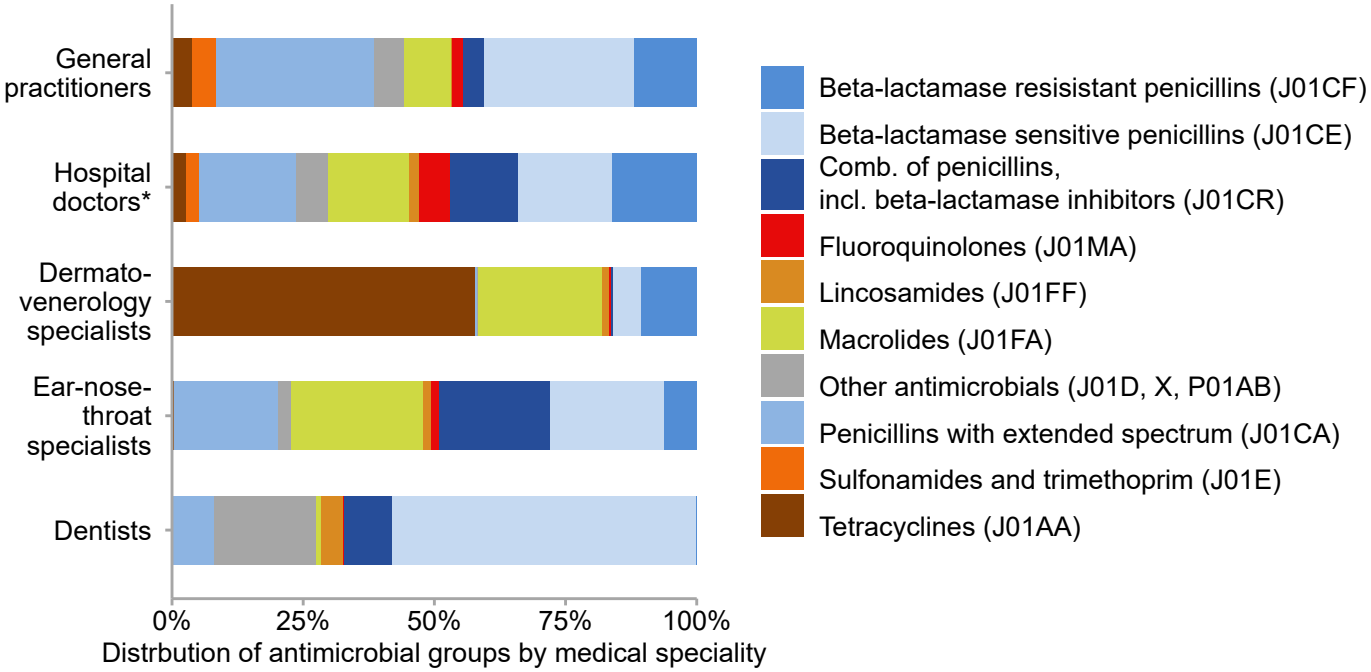
Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

5.3.3 Antimicrobial consumption by prescriber

Prescribing trends in primary health care clearly differ by prescribers' specialties. Table 5.5 shows an overview of the number of prescriptions issued by different specialists, including hospital doctors issuing prescriptions for patients at hospitals, which are then redeemed at a community pharmacy. Figure 5.8 shows the main antimicrobial groups prescribed by medical specialty in primary health care in 2025. In general practice, beta-lactamase sensitive penicillins and penicillins with extended spectrum were the most prescribed (29% and 30%, respectively) indicating adherence to the guidelines recommending beta-lactamase sensitive penicillins as the drug of choice in many common infections. In 2025, 58% of antimicrobial prescriptions from dermato-venerology specialists were tetracyclines, which are indicated for treatment of severe acne and sexually transmitted chlamydia/mycoplasma infections. The majority of prescriptions by dentists were narrow-spectrum beta-lactamase sensitive penicillins (58%) reflecting adherence to the recommended first-line treatment for common dental infections in primary health care.

General practitioners have access to their own prescribing data through ordiprax+, an online dashboard with personal log-in visualising prescription data and enabling comparisons with other practices at the regional level (DANMAP 2020 Textbox 5.2). Additionally, general practitioners are organized in quality clusters where improvement of antimicrobial prescribing is discussed among other topics.

Figure 5.8 Antimicrobial groups prescribed by main medical specialties in primary health care, Denmark, 2025 DANMAP 2025



*Hospital doctors issuing prescriptions for patients in ambulatory care or upon discharge from hospital.
Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Table 5.5 Number of prescriptions per 1,000 inhabitants by main medical specialties, Denmark, 2021-2025 DANMAP 2025

Prescriber		2021	2022	2023	2024	2025
General practitioners	Prescriptions per 1,000 inhabitants	279	300.9	323.1	305.5	0
	DDD per prescription	11	10.8	10.9	11.2	11.3
Hospital doctors*	Prescriptions per 1,000 inhabitants	63.5	62	65.6	64.3	31.4
	DDD per prescription	13.2	13.6	13.7	14.4	15
Ear-nose-throat specialists	Prescriptions per 1,000 inhabitants	6.9	8.1	8.5	8.1	7.5
	DDD per prescription	8.3	8.1	8	8.1	8.2
Dermato-venerology specialists	Prescriptions per 1,000 inhabitants	5	4.6	4.4	4.4	3.9
	DDD per prescription	35.4	35	34.6	37.1	35.4
Dentists	Prescriptions per 1,000 inhabitants	28.9	34.4	33.1	32.8	35.2
	DDD per prescription	7.7	7.7	8.2	8.2	8

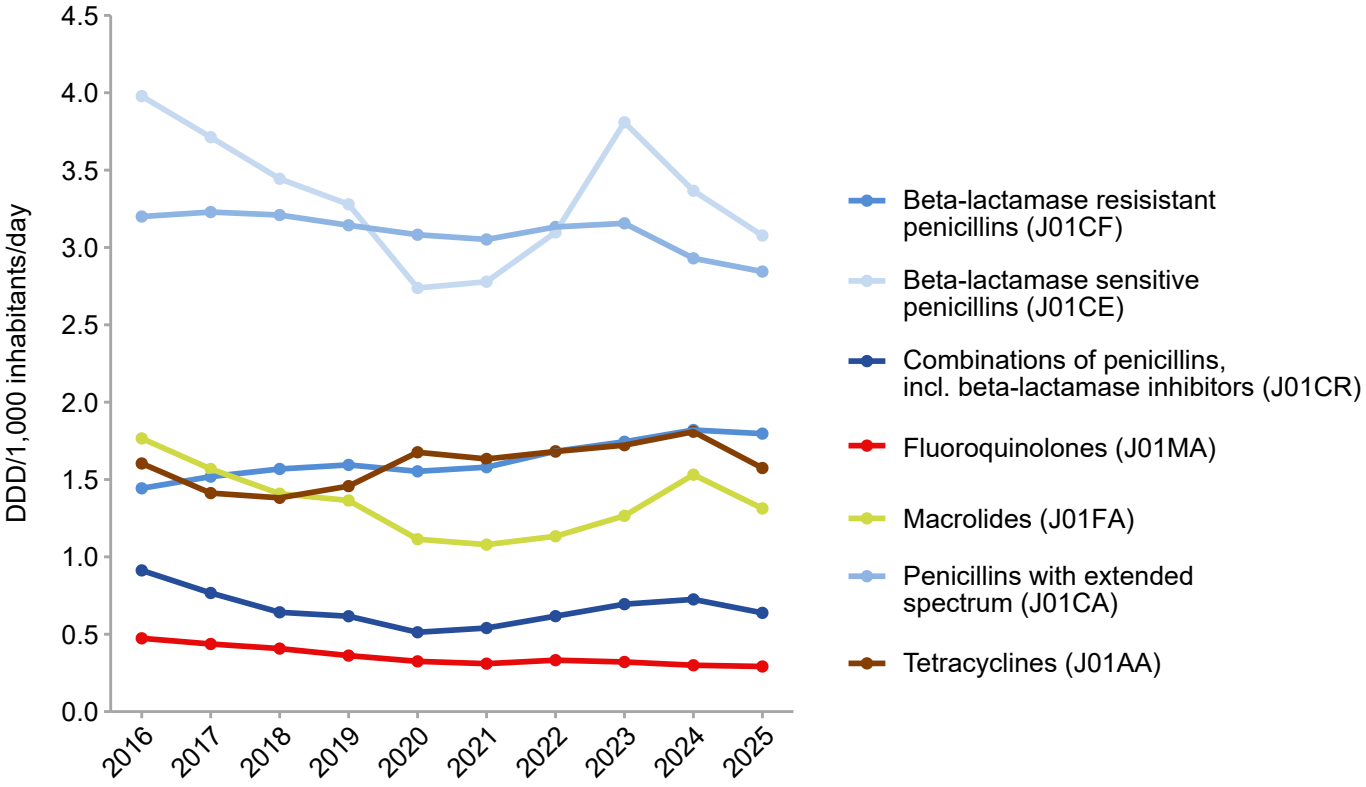
*Hospital doctors issuing prescriptions for patients in ambulatory care or upon discharge from hospital.
Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

5.3.4 Consumption of antimicrobial groups

In compliance with treatment guidelines, beta-lactamase sensitive penicillins have been the most used antimicrobials in primary health care in Denmark for decades (Figure 5.9). In 2025, beta-lactamase sensitive penicillins accounted for 24% of total consumption in primary health care. The steep increase of these penicillins, observed post COVID-19 and attributed to a renormalized circulation of airway infections, discontinued in 2024, (-11.6% from 2023 to 2024). Altogether, the four penicillin groups (penicillins with extended spectrum; beta-lactamase sensitive penicillins; beta-lactamase resistant penicillins; combinations of penicillins, including beta-lactamase inhibitors) accounted for 8.36 DID corresponding to 65% of antimicrobials consumed in primary health care in 2025. Other beta-lactams such as cephalosporins, monobactams and carbapenems were either used at an extremely low level or restricted to hospital use only. Consumption of macrolides increased by 21% from 2023 to 2024 attributed to the Group A streptococcal pandemic that circulated among children and their parents. In 2025, consumption of macrolides was 14% lower than in 2024.

Figure 5.9 Consumption of leading antimicrobial groups for systemic use in primary health care, DDD per 1,000 inhabitants per day, Denmark, 2016-2025

DANMAP 2025

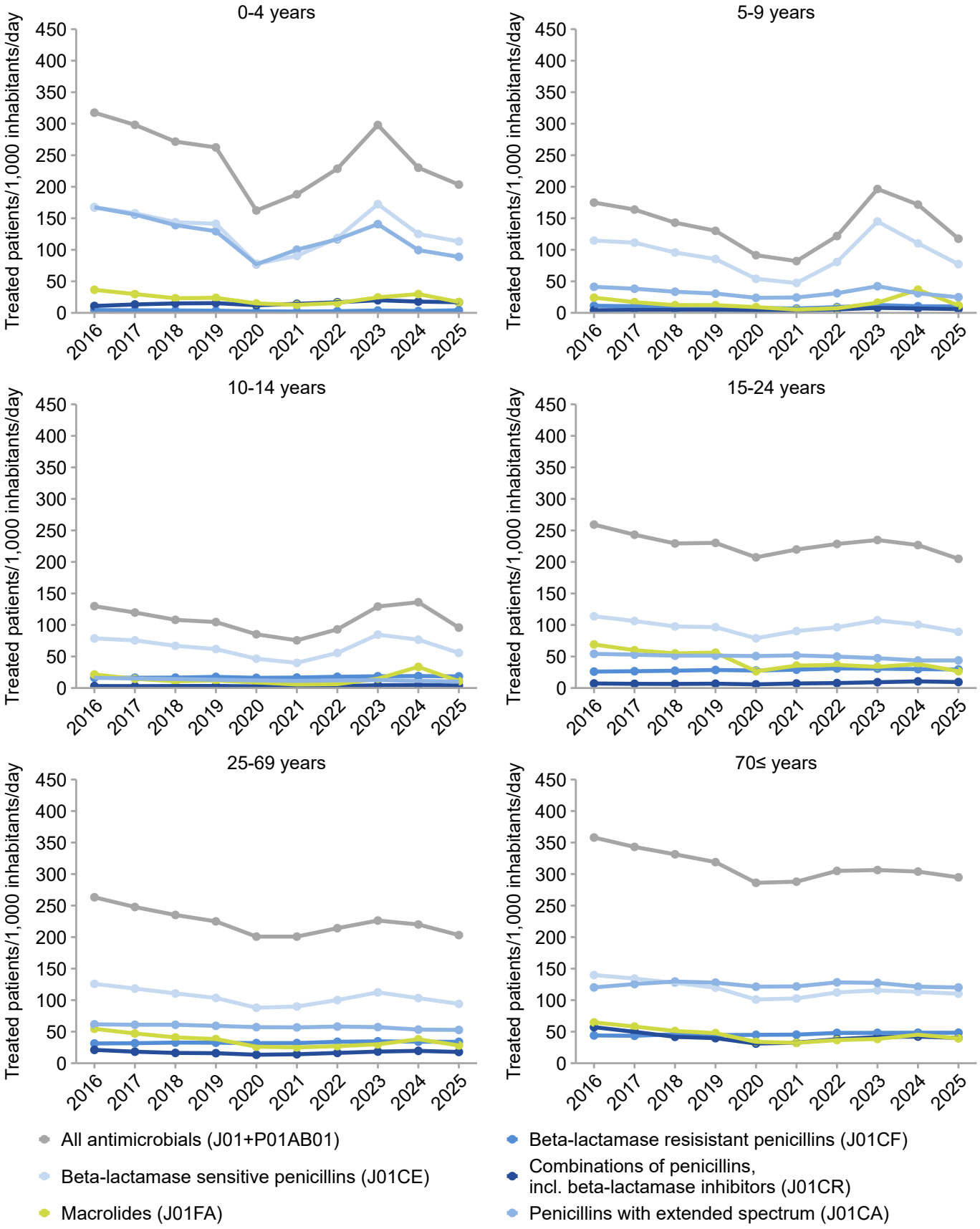


Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Macrolides play an important role in the treatment of bacterial respiratory tract infections in children and adolescents (Figure 5.10). Macrolides were also used as first-line treatment for chlamydia infections until the change in guidance (described in DANMAP2020), which may be the reason for the relatively high, but in recent years decreasing, consumption of macrolides in the 15-24-year-olds. However, penicillins continued to be the most used antimicrobial agents for children and adolescents, constituting between 67% and 89% of all antimicrobials prescribed depending on age group in 2025 (Figure 5.10).

Figure 5.10 Consumption of main antimicrobial agents by age group, treated patients/1,000 inhabitants, Denmark, 2016-2025

DANMAP 2025



Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

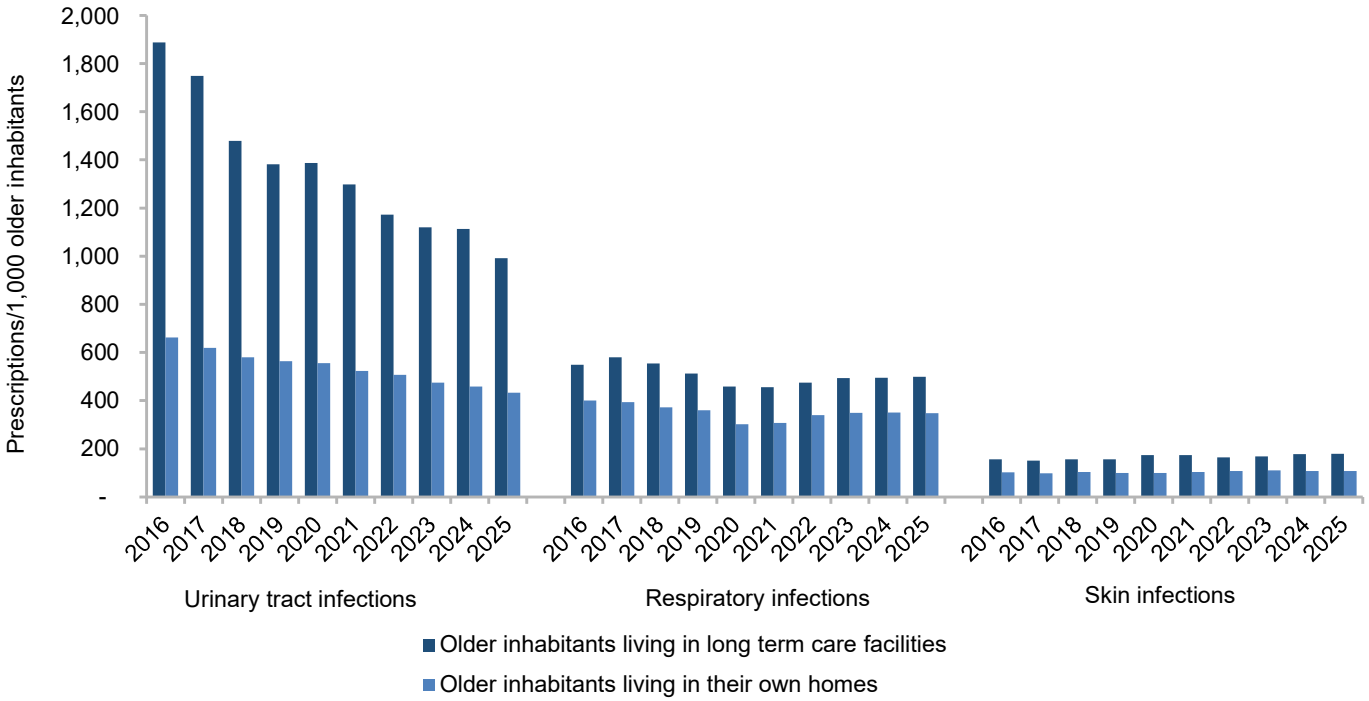
5.4 Antimicrobials among older inhabitants

One of the more recent additions to the DANMAP program is surveillance of antimicrobial consumption in older inhabitants aged 65 years and above. Close monitoring of infections in this population is necessary, as it is one of the most fragile populations in society. Surveillance of antimicrobial consumption contributes to high-quality treatment of infections and thereby prevents the emergence of antimicrobial resistant pathogens.

Based on data in the Danish Care Home Register and the Danish Civil Registry, it is possible to divide older inhabitants into two populations; older living in their own homes and older living at long-term care facilities. Figure 5.11 shows decreasing antimicrobial consumption for older inhabitants aged 65 years and above in 2016-2025, with a steeper decrease in consumption for older living at care homes. The figure compares trends in prescription codes for different infectious entities.

Figure 5.11 Consumption of antimicrobials in primary health care for older inhabitants (≥65 years) living in long-term care facilities or in their own homes, Denmark, 2016-2025

DANMAP 2025



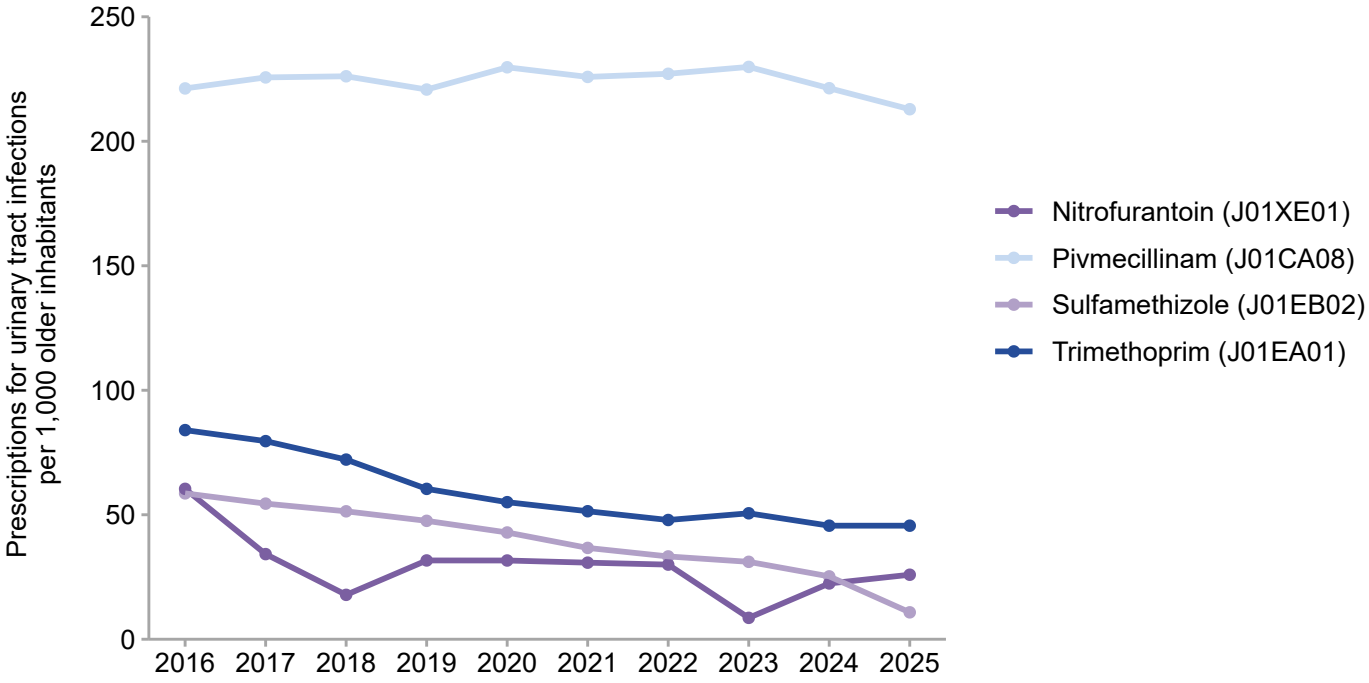
Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics, and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system, Care Home Register and Danish Civil Registry.

The main indication for antimicrobial treatment among older patients is urinary tract infections. Higher prevalence of urinary tract infections among older people at long-term care facilities has been observed for many years (Figure 5.11). In 2025, 991 prescriptions were issued per 1,000 inhabitants at long-term care facilities, whereas 433 prescriptions were issued per 1,000 inhabitants living in their own homes. The difference was less pronounced for respiratory (449 and 347 prescriptions per 1,000 inhabitants, respectively), and skin infections (179 and 108 prescriptions per 1,000 inhabitants, respectively). Figures 5.12, 5.13 and 5.14 show the consumption of antimicrobial agents for specific infections based on the indication on prescriptions for older inhabitants (≥70 years).

The Danish national action plan about antimicrobial resistance in human health emphasizes the importance of improving knowledge and awareness about infection prevention and control at long-term care facilities, but also among the older in general.

Figure 5.12 Antimicrobial prescriptions indicated for treatment of urinary tract infections in primary health care, prescriptions per 1,000 older inhabitants (≥70 years), Denmark, 2016-2025

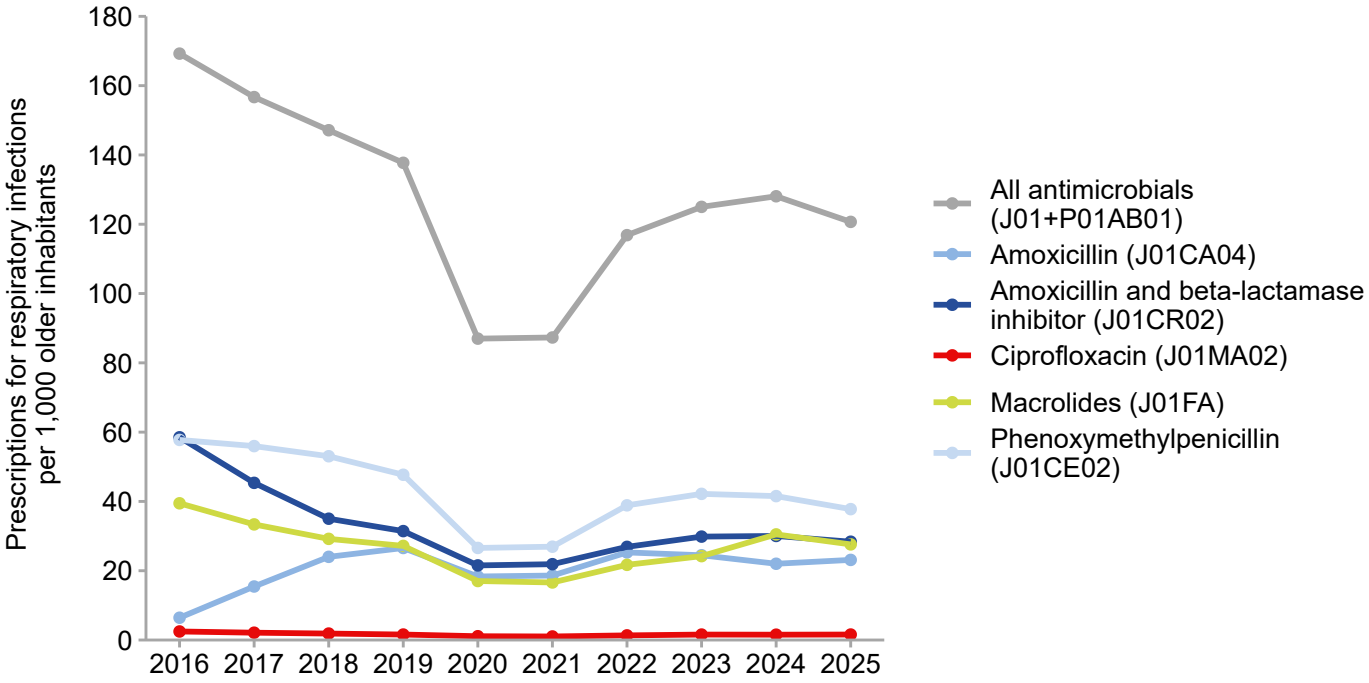
DANMAP 2025



Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Figure 5.13 Antimicrobial prescriptions indicated for treatment of respiratory tract infections in primary health care, prescriptions per 1,000 older inhabitants (≥70 years), Denmark, 2016-2025

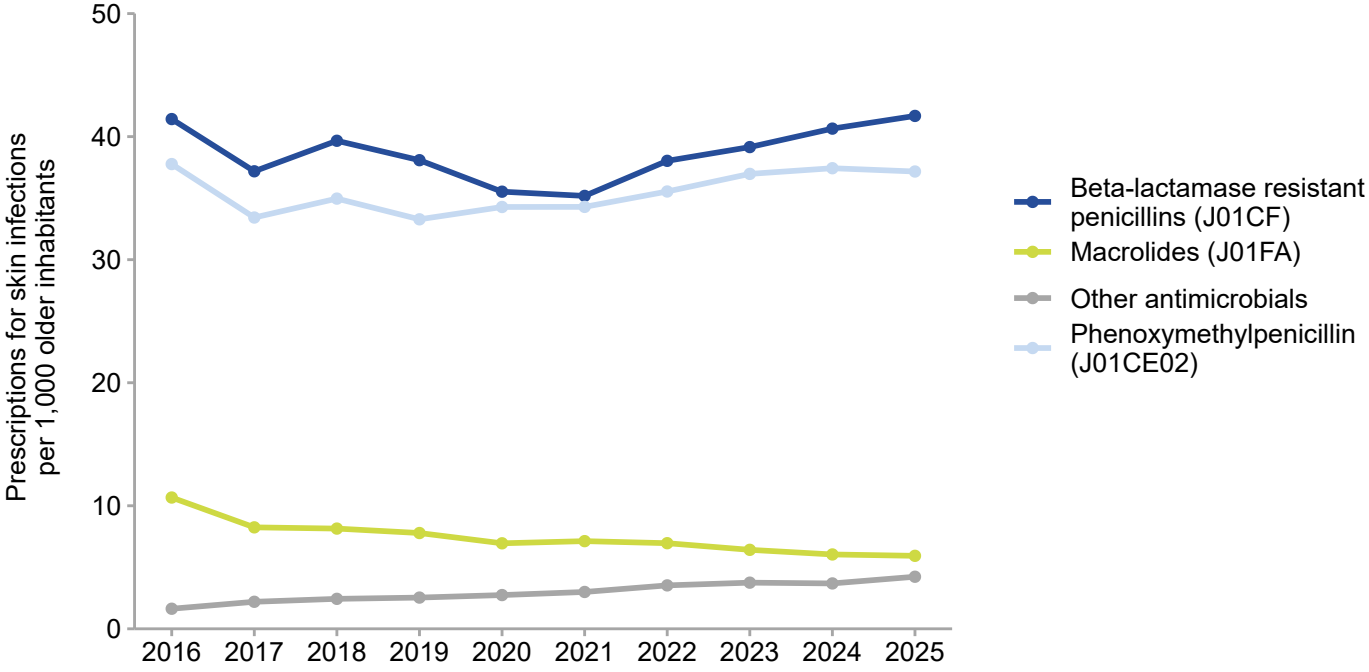
DANMAP 2025



Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Figure 5.14 Antimicrobial prescriptions indicated for treatment of skin infections in primary health care, prescriptions per 1,000 older inhabitants (≥70 years), Denmark, 2016-2025

DANMAP 2025



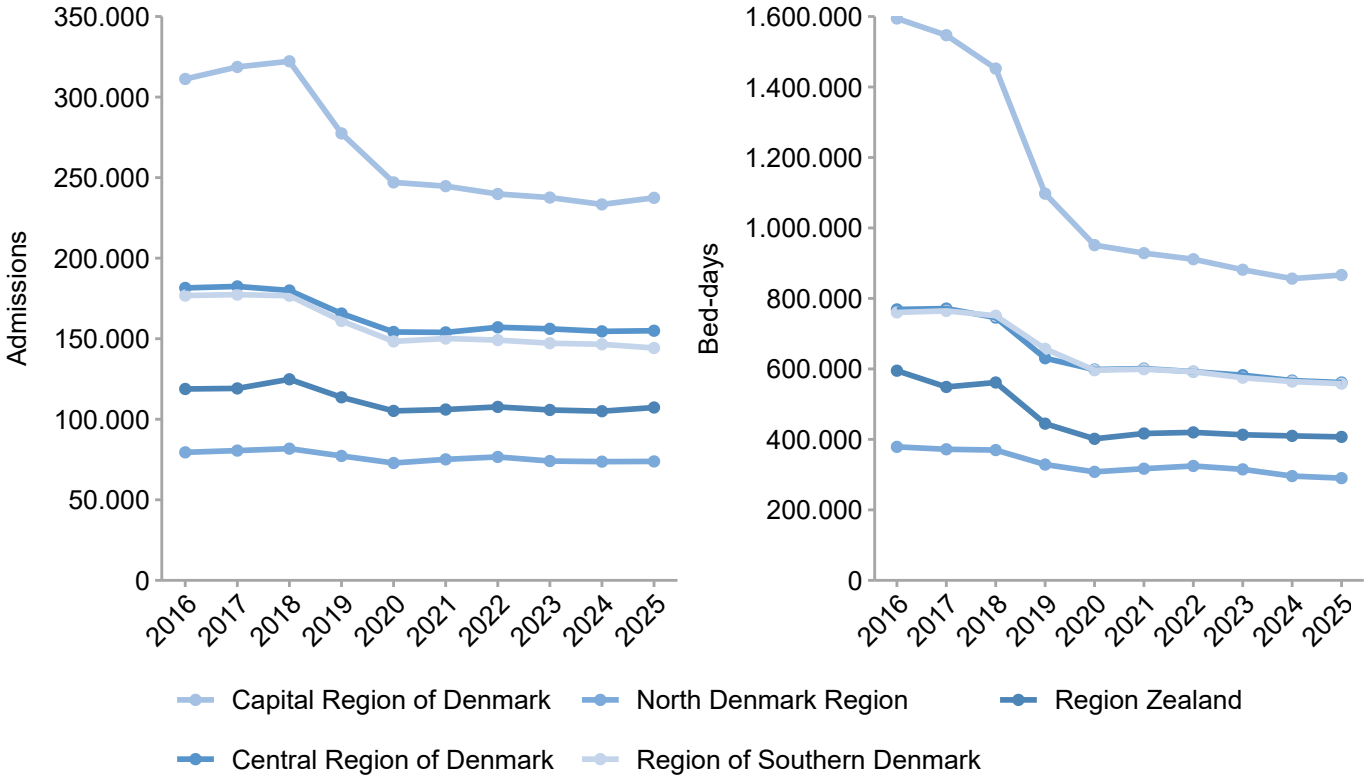
Data: Registered sales of antimicrobials to individuals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

5.5 Antimicrobial consumption in hospital care

Surveillance of antimicrobial consumption in hospital care is based on sales of systemic antimicrobials (ATC codes J01, P01AB01 and A07AA09) from Danish hospital pharmacies to hospitals, excluding private hospitals and psychiatric departments (approximately 2-3% of the total hospital consumption). Antimicrobial consumption data are presented as DDD per 100 occupied bed-days (DBD) and per 100 admissions (DAD) to account for hospital activity. The consumption is also presented as DDD per 1,000 inhabitants per day to enable comparison with consumption in primary health care and to correct for changes in consumption data based on changes in hospital activity, the background population being a more stable denominator.

Hospital activity has changed over the years with a decreasing number of bed-days and admissions, although at differing rates (Figure 5.15). Earlier discharge of patients, increasing ambulatory care functions in the community as well as in care homes and changed workflow due to new electronic systems all affect the activity and need to be considered when interpreting antimicrobial consumption trends in hospitals. Information on consumption at the patient level is currently not available to DANMAP for the hospital sector. This information is expected to become available to DANMAP through the "Hospital Medicine Register" in the coming years.

Figure 5.15 Activity at somatic hospitals, bed-days and admissions, Denmark, 2016-2025 DANMAP 2025



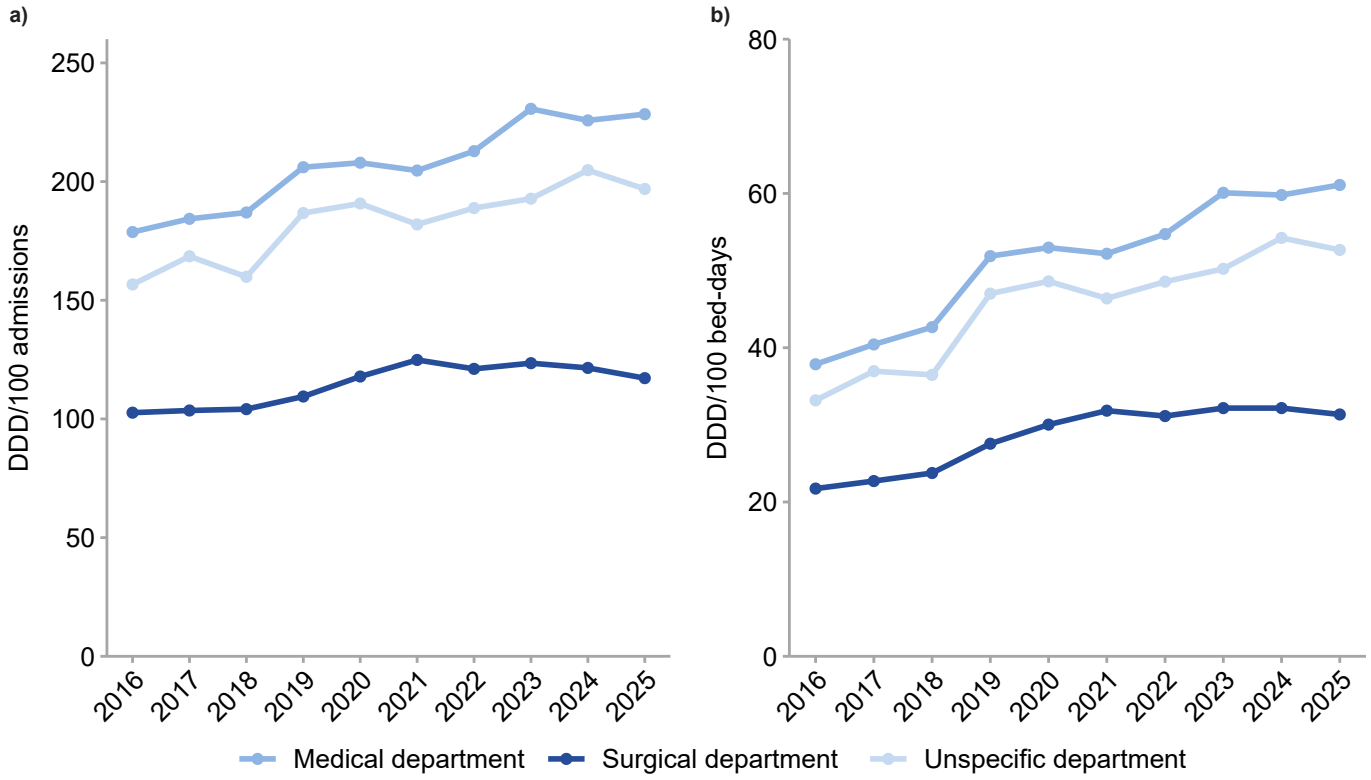
Data source: National Patient Register.
Data from the National Patient Register are subject to change due to continuous development of the new National Patient Register. This means that data will be continuously updated.

5.5.1 Antimicrobial consumption at public somatic hospitals accounting for hospital activity

Antimicrobial consumption at hospitals can be monitored based on the type of department. Figure 5.16 shows the highest share of consumption at medical departments (42%) in 2025, whereas surgical departments accounted for 22%. However, a significant part of the consumption could not be assigned to a specific hospital department (36%) which necessitates careful interpretation of data at this hospital organizational level.

Figure 5.16 Antimicrobial consumption at hospitals by type of department, a) DDD per 100 admissions and b) DDD per 100 bed-days, Denmark, 2016-2025

DANMAP 2025



Data: Antimicrobial consumption at somatic hospitals.
Data source: Register of Medicinal Product Statistics, the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and The National Patient Register.

In 2025, the consumption of antimicrobial agents at somatic hospitals was 144.7 DBD. This is similar to 2024 (145.2 DBD) and 55% higher than a decade ago (92.8 DBD in 2016) (Table 5.6). The four penicillin groups (penicillins with extended spectrum, beta-lactamase sensitive penicillins, beta-lactamase resistant penicillins and combinations of penicillins, including beta-lactamase inhibitors) accounted for 80.6 DBD, corresponding to 56% of the total consumption of antimicrobials at somatic hospitals in Denmark in 2025. The main group of antimicrobials in 2025; combinations of penicillins, including beta-lactamase inhibitors increased by 75% since 2016 (Figure 5.18). However, the conusmption started decreasing since 2024, in 2025 by 3.5% compared to 2024.

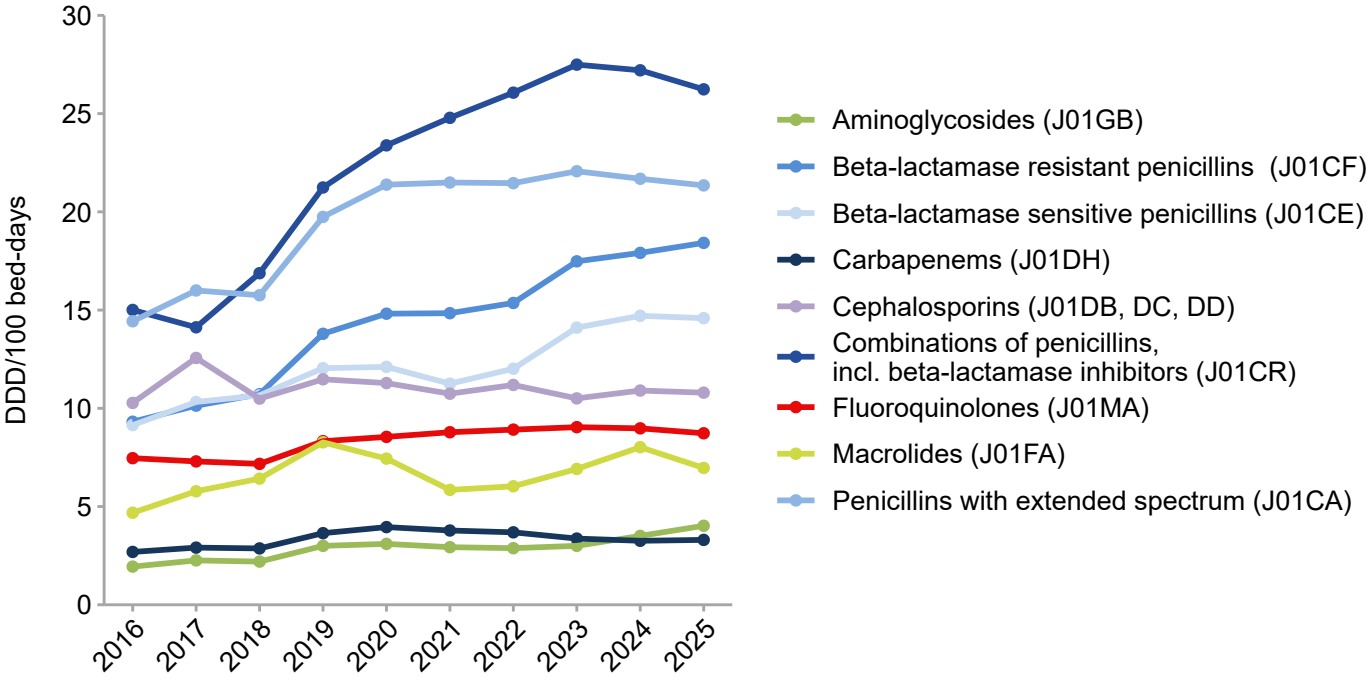
Much has changed within the choice and usage of antimicrobials at Danish hospitals, an example being the increase in combination penicillins as an attempt to reduce the usage of cephalosporins, while recent initiatives now include the combination penicillins among the broad-spectrum antimicrobials that should be closely monitored and, whenever possible, replaced by narrow-spectrum penicillins (Figure 5.17). These initiatives were included in the latter and the new Danish national action plan against antimicrobial resistance (DANMAP2021, Textbox 5.1 and DANMAP2024, Textbox 1.1).

Linezolid consumption was 0.64 DBD in 2025 which is 12% lower than in 2024 (0.73 DBD). The consumption of linezolid has shown fluctuating trends but increased by 78% over the past decade (0.36 DBD in 2016). Consumption of daptomycin has been stable in recent years at 0.13 DBD since 2022 (Table 5.6).

Although the overall consumption of both antimicrobials is low, sudden changes are of concern due to the high risk of resistance in enterococci and staphylococci. Moreover, the consumption is concentrated at highly specialized tertiary care hospitals in Denmark, which can result in local selection pressure for resistant bacteria.

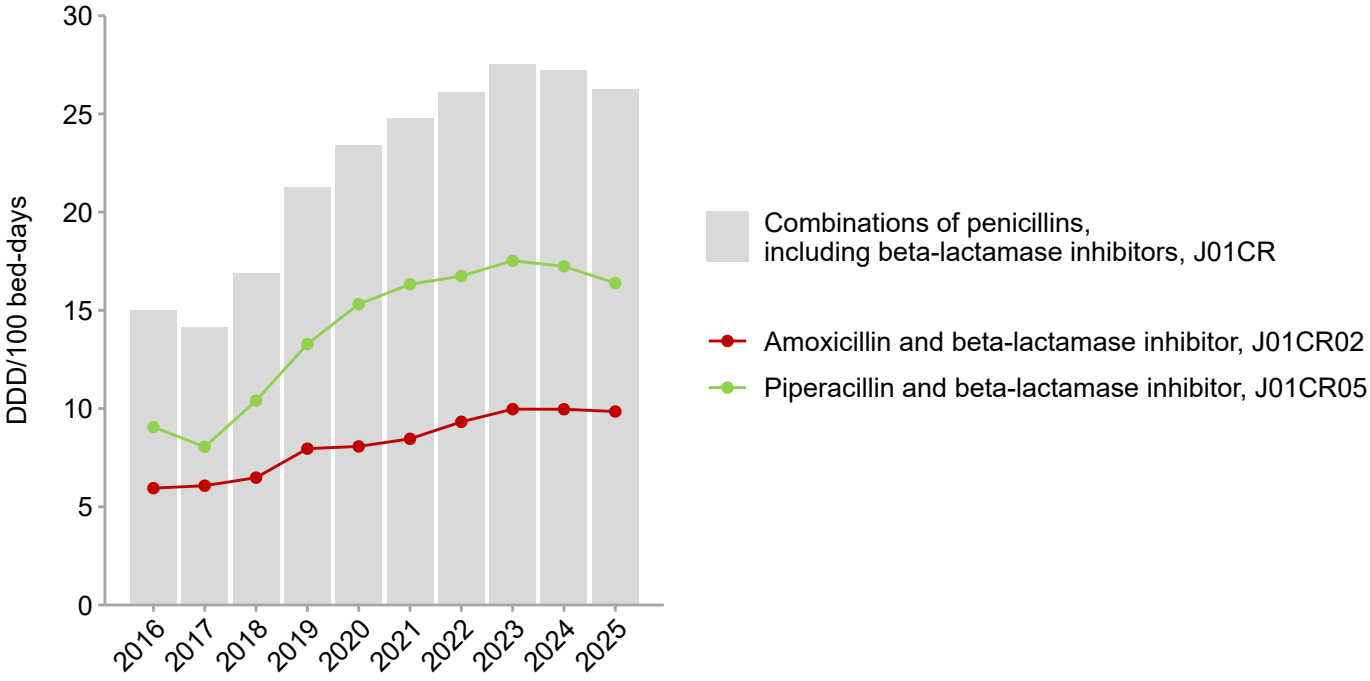
The consumption data at hospitals are presented in Table 5.6 by number of bed-days and in Table 5.7 by number of admissions.

Figure 5.17 Consumption of leading groups of antimicrobial agents at somatic hospitals, DDD per 100 bed-days, Denmark, 2016-2025 DANMAP 2025



Data: Antimicrobial consumption at somatic hospitals.
Data source: Register of Medicinal Product Statistics, the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and The National Patient Register.

Figure 5.18 Consumption of combination penicillins at somatic hospitals, DDD per 100 bed-days, Denmark, 2016-2025 DANMAP 2025



Data: Antimicrobial consumption at somatic hospitals.
Data source: Register of Medicinal Product Statistics, the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and National Patient Register.

Table 5.6 Consumption of antimicrobial agents for systemic use in somatic hospitals, DDD per 100 bed-days, Denmark, 2016-2025

DANMAP 2025

ATC group	Therapeutic group	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
J01AA	Tetracyclines	2.09	2.07	2.43	3.87	3.29	3.40	3.69	4.20	4.49	4.06
J01CA	Penicillins with extended spectrum	14.43	16.00	15.76	19.74	21.38	21.49	21.46	22.07	21.68	21.35
J01CE	Beta-lactamase sensitive penicillins	9.15	10.32	10.66	12.04	12.11	11.25	12.01	14.11	14.71	14.59
J01CF	Beta-lactamase resistant penicillins	9.32	10.14	10.72	13.79	14.82	14.84	15.36	17.48	17.91	18.42
J01CR	Comb. of penicillins. incl. beta-lactamase inhibitors	15.01	14.12	16.88	21.24	23.38	24.78	26.07	27.49	27.20	26.24
J01DB	First-generation cephalosporins	0.04	0.04	0.04	0.03	0.04	0.04	0.03	0.03	0.01	0.00
J01DC	Second-generation cephalosporins	9.21	11.18	9.23	9.98	9.79	9.26	9.56	8.94	9.32	9.27
J01DD	Third-generation cephalosporins	1.03	1.35	1.23	1.46	1.45	1.45	1.59	1.54	1.58	1.52
J01DF	Monobactams	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.03	0.04
J01DH	Carbapenems	2.69	2.91	2.87	3.64	3.95	3.78	3.69	3.37	3.26	3.30
J01EA	Trimethoprim and derivatives	0.37	0.42	0.45	0.49	0.55	0.51	0.48	0.45	0.40	0.39
J01EB	Short-acting sulfonamides	0.10	0.10	0.10	0.11	0.08	0.08	0.06	0.05	0.05	0.03
J01EE	Comb. of sulfonamides and trimethoprim. incl. derivatives	5.34	5.67	6.14	8.19	8.86	9.71	10.04	11.20	12.10	13.71
J01FA	Macrolides	4.68	5.78	6.42	8.27	7.44	5.85	6.03	6.91	8.02	6.97
J01FF	Lincosamides	0.62	0.65	0.78	0.91	0.88	0.83	0.85	0.91	0.94	1.01
J01GB	Aminoglycosides	1.94	2.26	2.20	3.00	3.10	2.93	2.88	3.00	3.51	4.02
J01MA	Fluoroquinolones	7.46	7.30	7.17	8.33	8.55	8.78	8.92	9.04	8.98	8.73
J01XA	Glycopeptides	1.08	1.33	1.30	1.64	1.82	1.83	1.78	1.66	1.90	1.97
J01XB	Polymyxins	0.19	0.19	0.23	0.27	0.29	0.29	0.30	0.36	0.47	0.36
J01XC	Steroid antibacterials (fusidic acid)	0.11	0.07	0.06	0.07	0.06	0.07	0.05	0.06	0.05	0.02
J01XD	Imidazole derivatives	4.50	4.71	4.44	5.05	5.19	4.79	4.64	4.57	4.46	4.33
J01XE	Nitrofuran derivatives (nitrofurantoin)	0.24	0.26	0.28	0.35	0.43	0.38	0.38	0.46	0.38	0.32
J01XX05	Methenamine	0.08	0.07	0.11	0.10	0.10	0.14	0.13	0.15	0.13	0.14
J01XX08	Linezolid	0.36	0.38	0.54	0.65	0.60	0.61	0.68	0.68	0.73	0.64
J01XX09	Daptomycin	0.05	0.08	0.15	0.08	0.12	0.15	0.13	0.13	0.13	0.13
A07AA09	Vancomycin	0.48	0.53	0.51	0.67	0.81	0.70	0.82	0.87	0.91	0.94
P01AB01	Metronidazole	2.17	2.06	1.99	2.35	2.42	2.32	2.26	2.28	1.81	2.15
J01, P01AB01, A07AA09	All antimicrobial agents for systemic use, incl. metronidazole and vancomycin	92.8	100.0	102.7	126.3	131.5	130.3	133.9	142.0	145.2	144.7

Data: Antimicrobial consumption at somatic hospitals.
Data source: The Register of Medicinal Product Statistics, the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and National Patient Register.

Table 5.7 Consumption of antimicrobial agents for systemic use in somatic hospitals, DDD per 100 admissions, Denmark, 2016-2025

DANMAP 2025

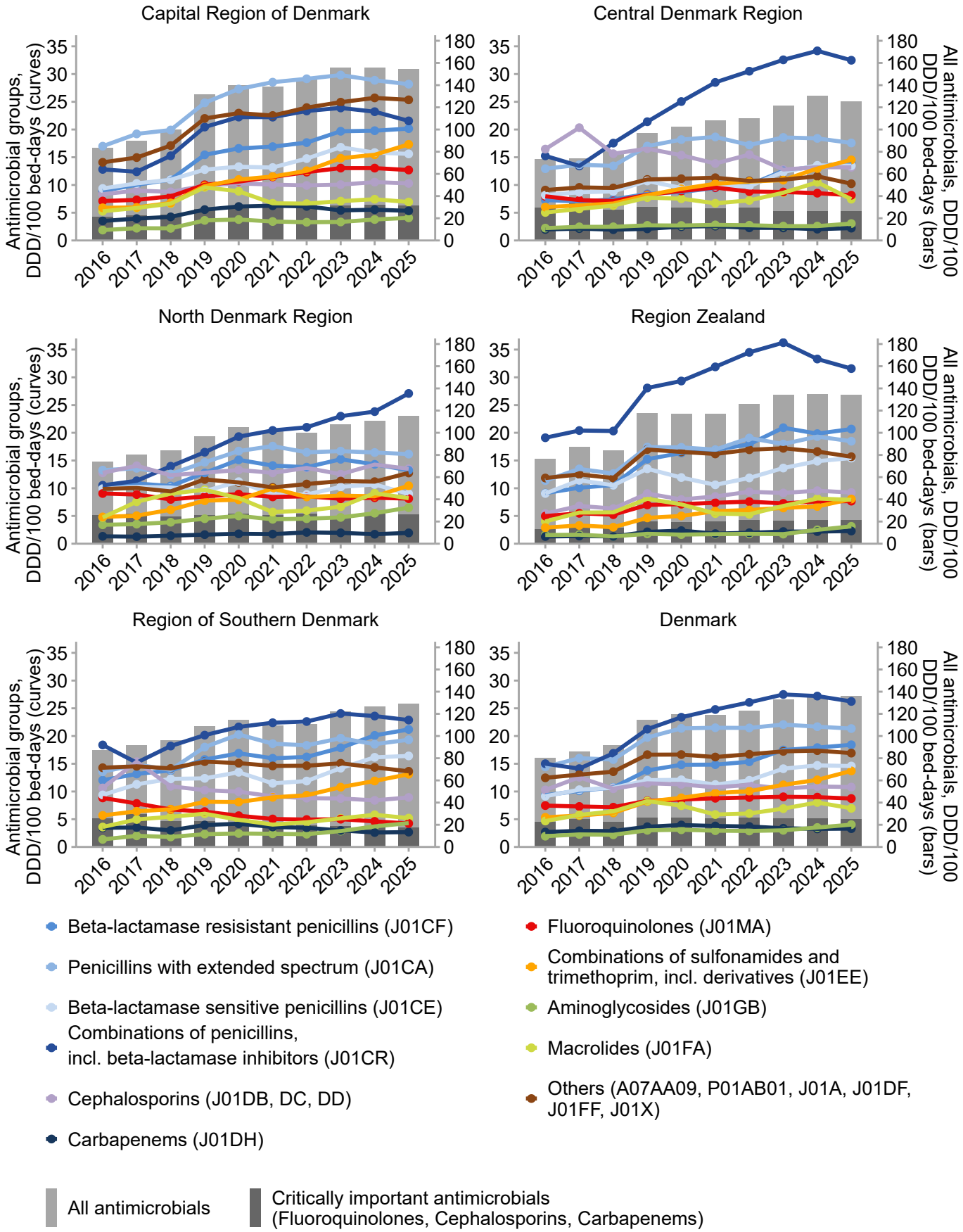
ATC group	Therapeutic group	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
J01AA	Tetracyclines	9.88	9.44	10.66	15.36	12.93	13.35	14.33	16.14	16.97	15.16
J01CA	Penicillins with extended spectrum	68.14	72.94	69.04	78.43	83.93	84.28	83.45	84.70	81.88	79.80
J01CE	Beta-lactamase sensitive penicillins	43.19	47.05	46.72	47.83	47.53	44.12	46.72	54.16	55.54	54.53
J01CF	Beta-lactamase resistant penicillins	43.99	46.21	46.97	54.79	58.15	58.20	59.74	67.10	67.64	68.85
J01CR	Comb. of penicillins. incl. beta-lactamase inhibitors	70.86	64.39	73.96	84.37	91.78	97.19	101.36	105.53	102.73	98.07
J01DB	First-generation cephalosporins	0.20	0.19	0.17	0.13	0.15	0.14	0.13	0.11	0.05	0.02
J01DC	Second-generation cephalosporins	43.47	50.95	40.43	39.64	38.43	36.32	37.18	34.32	35.18	34.66
J01DD	Third-generation cephalosporins	4.85	6.14	5.39	5.82	5.70	5.67	6.19	5.90	5.95	5.67
J01DF	Monobactams	0.05	0.03	0.03	0.05	0.04	0.02	0.06	0.03	0.12	0.13
J01DH	Carbapenems	12.70	13.26	12.57	14.47	15.52	14.83	14.34	12.93	12.30	12.35
J01EA	Trimethoprim and derivatives	1.76	1.91	1.96	1.95	2.14	2.01	1.86	1.74	1.53	1.47
J01EB	Short-acting sulfonamides	0.47	0.47	0.45	0.43	0.30	0.30	0.24	0.18	0.19	0.12
J01EE	Comb. of sulfonamides and trimethoprim. incl. derivatives	25.23	25.83	26.90	32.54	34.76	38.08	39.06	42.98	45.68	51.25
J01FA	Macrolides	22.11	26.33	28.14	32.84	29.19	22.93	23.45	26.54	30.29	26.04
J01FF	Lincosamides	2.94	2.98	3.42	3.62	3.44	3.25	3.31	3.49	3.56	3.79
J01GB	Aminoglycosides	9.17	10.29	9.63	11.91	12.16	11.49	11.20	11.52	13.24	15.03
J01MA	Fluoroquinolones	35.23	33.27	31.43	33.07	33.54	34.44	34.67	34.70	33.91	32.63
J01XA	Glycopeptides	5.11	6.05	5.69	6.52	7.15	7.16	6.90	6.38	7.16	7.37
J01XB	Polymyxins	0.91	0.89	1.02	1.07	1.14	1.12	1.15	1.37	1.77	1.35
J01XC	Steroid antibacterials (fusidic acid)	0.54	0.31	0.28	0.28	0.25	0.27	0.21	0.22	0.18	0.09
J01XD	Imidazole derivatives	21.24	21.45	19.44	20.06	20.36	18.77	18.05	17.55	16.83	16.19
J01XE	Nitrofuran derivatives (nitrofurantoin)	1.12	1.17	1.21	1.37	1.67	1.47	1.49	1.76	1.43	1.20
J01XX05	Methenamine	0.37	0.33	0.47	0.38	0.41	0.54	0.51	0.59	0.50	0.52
J01XX08	Linezolid	1.71	1.71	2.35	2.59	2.34	2.39	2.63	2.61	2.74	2.38
J01XX09	Daptomycin	0.23	0.38	0.64	0.32	0.46	0.59	0.52	0.50	0.47	0.50
A07AA09	Vancomycin	2.29	2.40	2.22	2.66	3.18	2.76	3.19	3.34	3.45	3.51
P01AB01	Metronidazole	10.24	9.37	8.73	9.35	9.50	9.12	8.77	8.74	6.85	8.02
J01, P01AB01, A07AA09	All antimicrobial agents for systemic use, incl. metronidazole and vancomycin	438.0	455.7	449.9	501.9	516.2	510.8	520.7	545.1	548.1	540.7

Data: Antimicrobial consumption at somatic hospitals.
Data source: The Register of Medicinal Product Statistics, the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and National Patient Register.

Figures 5.19 and 5.20 show antimicrobial consumption at hospitals by health care region. The overall trends are similar to national level trends; however, the figures show different levels of antimicrobial consumption as well as different compositions of the consumption in the regions. Regions with highly specialised hospitals treating complicated infections, show higher and broader consumption of antimicrobials.

Figure 5.19 Consumption of antimicrobial agents for systemic use at hospitals in the five health regions, DDD per 100 bed-days, Denmark, 2016-2025

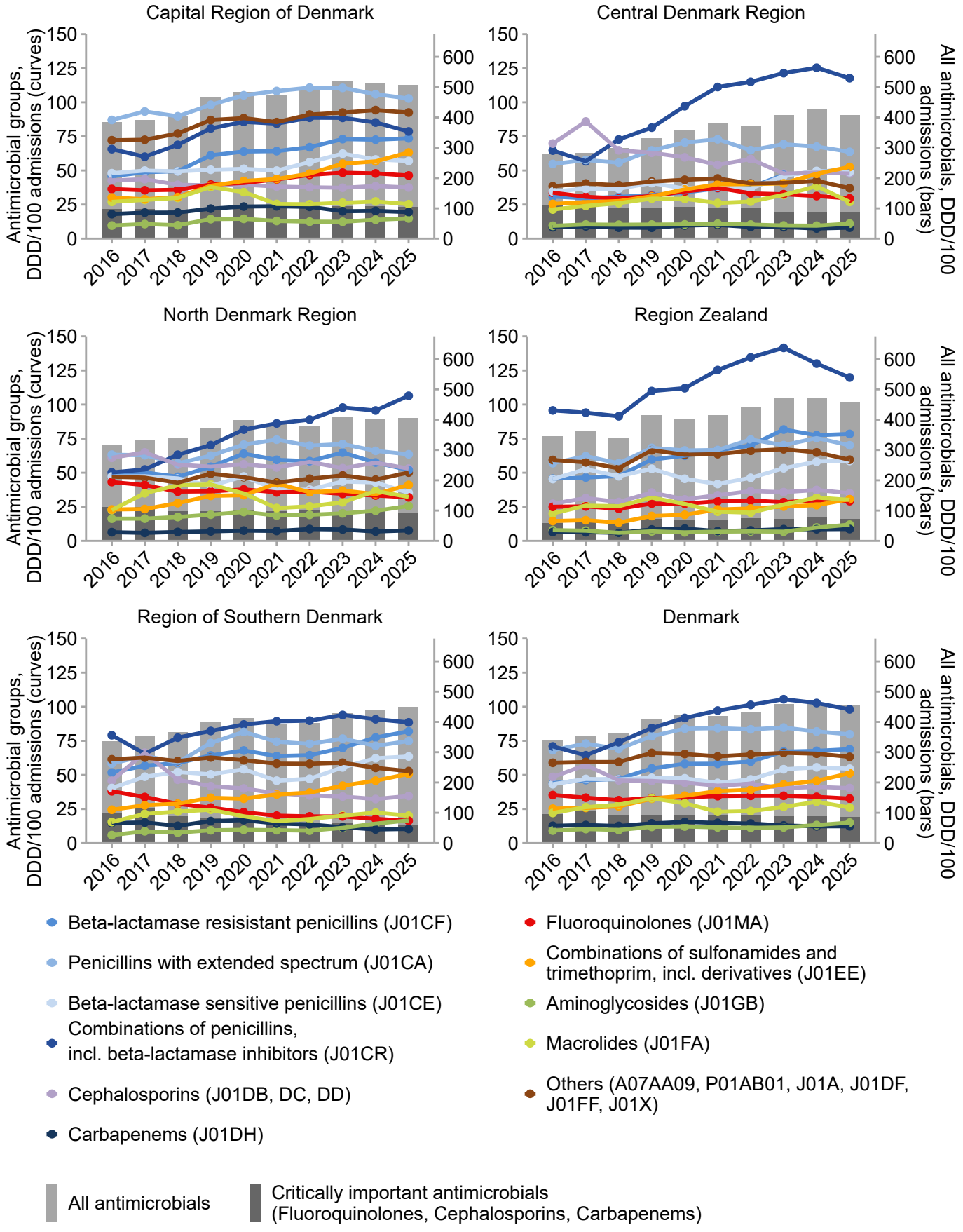
DANMAP 2025



Data: Antimicrobial consumption at somatic hospitals.
Data source: Register of Medicinal Product Statistics, and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and National Patient Register.

Figure 5.20 Consumption of antimicrobial agents for systemic use at hospitals in the five health regions, DDD per 100 admissions, Denmark, 2016-2025

DANMAP 2025



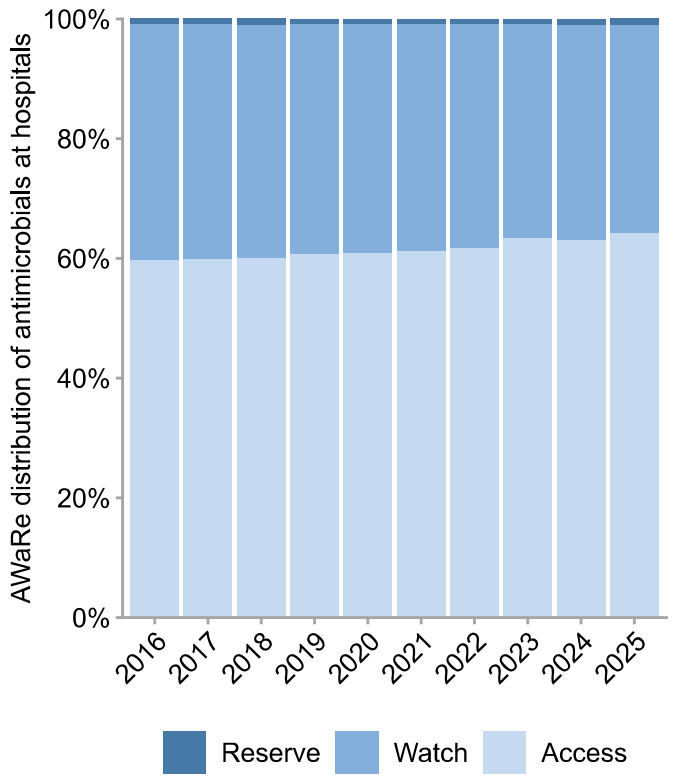
Data: Antimicrobial consumption at somatic hospitals.
Data source: Register of Medicinal Product Statistics, and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system and National Patient Register.

5.5.2 AWaRe classification of antimicrobials at Danish somatic hospitals

The World Health Organization (WHO) has developed the AWaRe classification system as a tool to assist antibiotic stewardship and to reduce antimicrobial resistance. Antibiotics are classified into three groups to emphasise the importance of their appropriate use:

- Access: Antibiotics used to treat common susceptible pathogens with lower resistance potential than antibiotics in the other groups. 60% of total antimicrobial consumption should consist of access agents.
- Watch: Antibiotics that have higher resistance potential, including most of the highest priority agents. These antibiotics should be prioritised as key targets of stewardship programs and monitoring.
- Reserve: Antibiotics reserved for treatment of confirmed or suspected infections due to multi-drug resistant organisms. These antibiotics should be considered as "last resort" options.

Figure 5.21 Percentage distribution of antimicrobials at somatic hospitals according to WHO AWaRe classification, DDD, Denmark, 2016-2025 DANMAP 2025



Data: Antimicrobial consumption at somatic hospitals.
Data source: Register of Medicinal Product Statistics and the 2026 edition of the Anatomical Therapeutic Chemical (ATC) classification system.

Antimicrobial consumption at Danish somatic hospitals has consisted of more than 60% "access antimicrobials" since 2016, and in 2025 the share was 64%. "Reserve antimicrobials" constituted 1% in all years (Figure 5.21).

Several hospitals work with a stricter classification of antimicrobials and have set up local criteria for the use of certain antimicrobials associated with observed increasing levels of resistance. For instance, amoxicillin and beta-lactamase inhibitor are moved from the access group to watch, and meropenem from the watch group to reserve.

5.5.3 Shortage of antimicrobials

Issues with supply chains of antimicrobials can lead to product shortages. Some shortages do not reach the patient due to the substitution rules in Denmark. Shortages can also be solved by using non-marketed antimicrobials on special delivery, which requires permission from the Danish Medicines Agency.

In 2025, levofloxacin and metronidazole were the most purchased antimicrobials via special deliveries (Table 5.8). In 2023, nitrofurantoin was hit by a shortage and even with increased supply via special deliveries, it was not possible to cover the whole need, which is why other antimicrobials were chosen for treatment.

In 2022, penicillin/beta-lactamase inhibitor combinations decreased sharply in July and August due to product shortages. However, prescribers had access to penicillin/beta-lactamase inhibitor combinations via special deliveries. Approximately 70,000 DDD of penicillin/betalactamase inhibitor combinations were purchased through special delivery in 2022, whereas in 2019-2021 the number was approximately 4,000 DDD (not shown). Special deliveries could not meet the demand for penicillin/beta-lactamase inhibitor combinations in 2017, which led to a significant decrease in consumption that year (Figure 5.17). Simultaneously, an increase in consumption of cephalosporins was observed.

Danish authorities have launched several initiatives at national, Nordic and European levels to improve and secure access to antimicrobials (Textbox 5.1 in DANMAP 2024).

Table 5.8 Consumption of selected antimicrobials on special delivery to hospitals, DDD, 2016-2025 DANMAP 2025

Antimicrobial	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
J01MA12 Levofloxacin	463	435	392	412	320	180	193	214	199	8,728
P01AB01 Metronidazole									525	4,025
J01FA09 Clarithromycin				6,895	6,840	4,790	3,850	2,620	2,780	3,365
J01GB01 Tobramycin	6,704	8,188	7,596	7,136	3,094	7,985	2,610	3,760	2,502	1,235
J01EE01 Sulfamethoxazole and trimethoprim	1,195	690	766	726	1,028	908	935	890	985	960
J01CF05 Flucloxacillin				125	500	225	325	275	700	870
J01MA02 Ciprofloxacin	160	160	200	425	390	466	1,067	533	856	728
J01CR02 Amoxicillin and beta-lactamase inhibitor	3,276	2,579	3,882	4,348	4,277	3,934	4,177	1,726		
J01CR05 Piperacillin and beta-lactamase inhibitor		16,465	4,457				63,808			
J01XE01 Nitrofurantoin								7,950	425	

Data: Consumption of antimicrobials on special delivery.
Data source: Danish Hospital Pharmacies.

We would like to acknowledge Maja Laursen from the National Health Data Authority in Denmark for data on antimicrobial consumption. We would also like to acknowledge all hospital pharmacies in Denmark for data on special delivery of antimicrobials to the hospitals. Finally, we would like to acknowledge the panel of experts from clinical microbiology laboratories and from research centers for general practice for their valuable input to this chapter.

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Textbox 5.1

The Danish Hospital Medication Register: new opportunities for examining antibiotic therapy in Danish hospitals

The Danish Hospital Medication Register provides patient-level data on medication administered in all public hospitals and affiliated hospital outpatient clinics in Denmark (1, 2). This register expands opportunities for pharmacoepidemiological research by enabling analyses of hospital medication use, including antibiotic treatment choices such as de-escalation strategies, and the transition from intravenous to oral therapy across different patient populations. Opposite the aggregated annual data reported in the DANMAP reports, the Danish Hospital Medication Register provides patient-level information on actual medication administrations. The Danish Hospital Medication can be linked with other Danish health registries, including the Danish National Prescription Registry, the Danish Microbiology Database, and the Danish National Patient Register, which provides a unique opportunity to examine complete antibiotic treatment courses spanning both hospital and community settings.

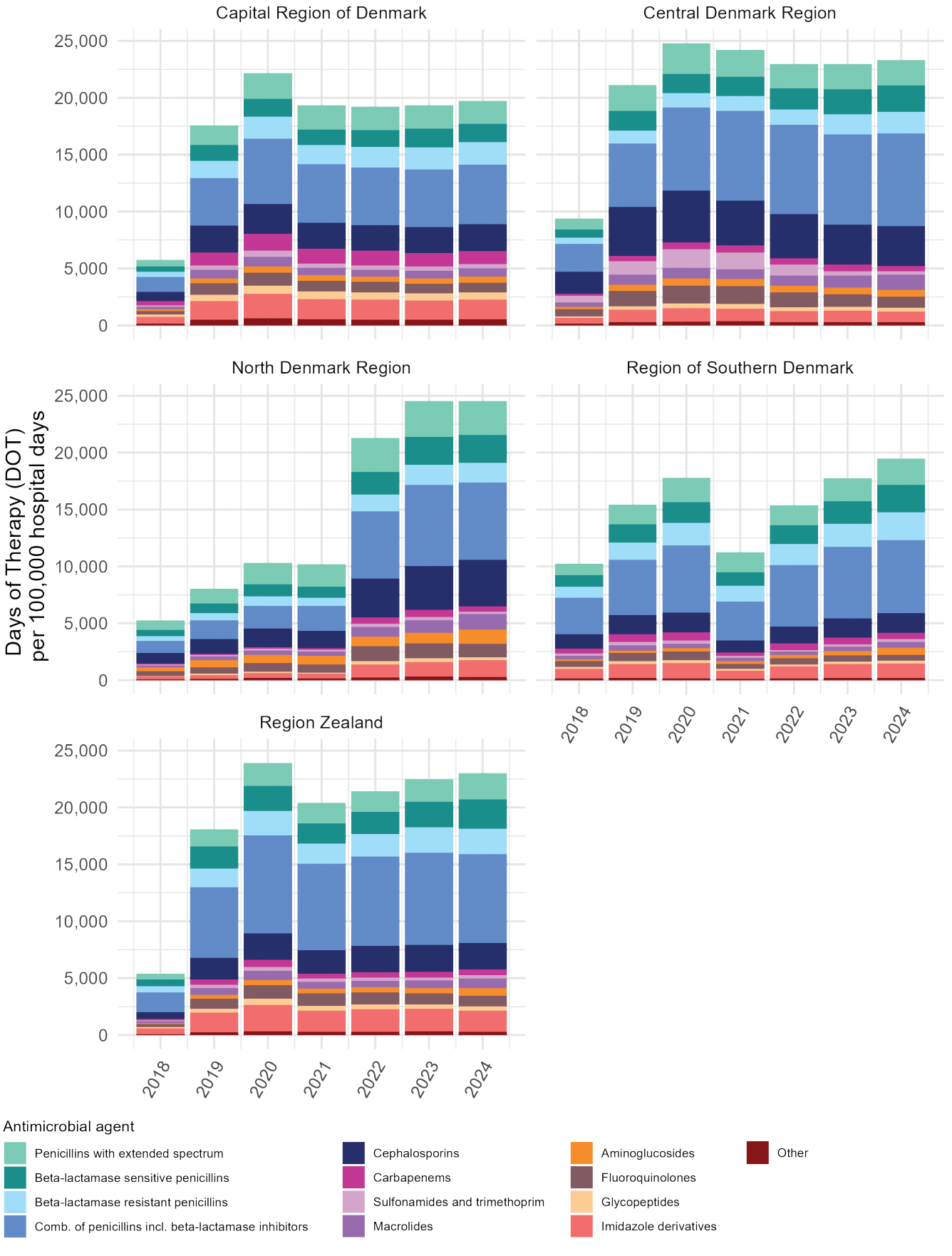
However, important differences in data recording should be considered. The Danish Hospital Medication Register records each medication administration, whereas the Danish National Prescription Registry records redeemed prescriptions, resulting in uncertainty regarding treatment duration and medication adherence. The patient-level data from the Danish Hospital Medication Register also enable calculation of measures relevant to antimicrobial stewardship such as the number of treated patients or Days of Therapy (DOT) (3). However, some variables, such as dose units, are incompletely recorded and/or coded using a wide range of different units, requiring substantial data management before analysis. No published studies have evaluated the validity of the Danish Hospital Medication Register.

This textbox aims to characterize the use of antimicrobial agents administered during hospitalization across hospital regions and age groups. The analyses include all antibiotics (ATC code group J01) recorded in the Danish Hospital Medication Register between 15 May 2018 and 11 November 2024. DOT were defined as the administration of at least one dose of a specific antimicrobial agent to an individual on a given calendar day (3). Each antimicrobial agent was counted separately (3). Therefore, a patient receiving several antimicrobial agents on the same day contributed one DOT per antimicrobial agent. Hospital days were defined as the total number of calendar days on which an individual had inpatient or outpatient hospital contact during the study period. A calendar day counts as one hospital day regardless of the number of hours spent at the hospital by the patient.

The number of DOT per 100,000 hospital days appeared lower in 2018 across all regions, likely reflecting incomplete reporting during the initial implementation of the register. In the North Denmark Region, DOT per 100,000 hospital days remained substantially lower until 2022, suggesting incomplete reporting during this period. Across all regions and years, combinations of penicillins including beta-lactamase inhibitors, accounted for the largest proportion of DOT. The distribution of antimicrobial agents was similar across hospital regions. The overall DOT per 100,000 hospital days was lower in the Region of Southern Denmark than in the other regions throughout the study period. In the Capital Region of Denmark, the Central Denmark Region, and Region Zealand, DOT per 100,000 hospital days was highest in 2020 (Figure 1).

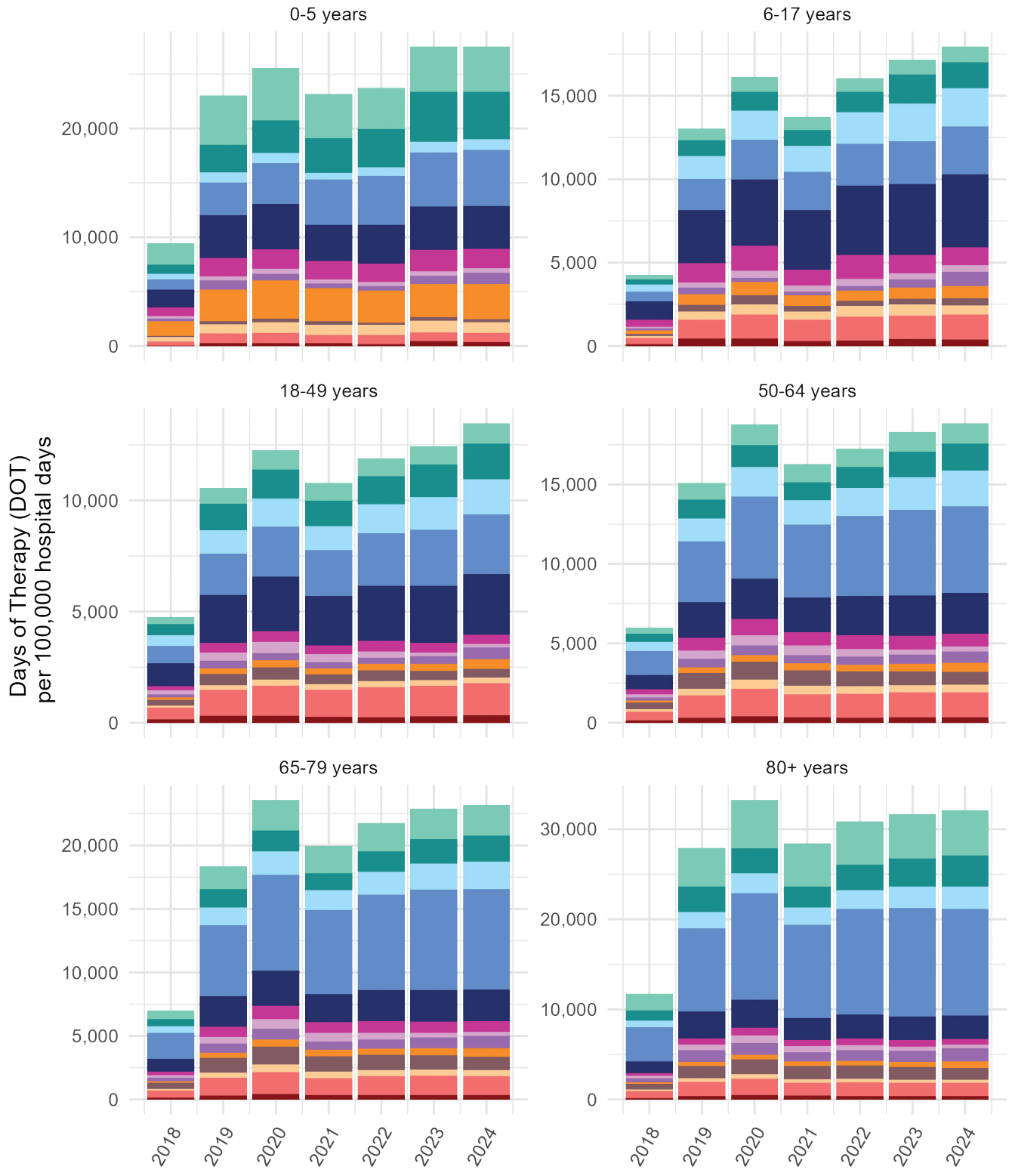
The overall DOT per 100,000 hospital days, summed across all antimicrobial agents, was highest among individuals aged 80 years and older, followed by children aged 0-5 years and individuals aged 65-79 years. Among individuals aged 0-5 years, 50-64 years, 65-79 years, and 80 years and older, combinations of penicillins including beta-lactamase inhibitors, accounted for the largest proportion of DOT. In contrast, cephalosporins accounted for the largest proportion of DOT among individuals aged 6-17 years and 18-49 years. Aminoglycosides contributed a higher proportion of DOT among children aged 0-5 years compared with the other age groups (Figure 2).

Figure 1. Days of Therapy (DOT) per 100,000 hospital days stratified by antimicrobial agent and hospital region DANMAP 2025



continued ... Textbox 5.1

Figure 2. Days of Therapy (DOT) per 100,000 hospital days stratified by antimicrobial agent and age group DANMAP 2025



In summary, the use of antimicrobial agents during hospitalization was similar across Danish regions, with combinations of penicillins including beta-lactamase inhibitors being the most commonly used antimicrobial agents. The overall DOT per 100,000 hospital days was highest among patients aged 80 years and older, while patterns of antimicrobial administration differed across age groups. Lower recorded use of antimicrobial agents in 2018 and in North Denmark until 2022 likely reflect incomplete reporting.

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Textbox 5.2

IMAGINE – improving antibiotic use in European nursing homes

Combining infection prevention and antimicrobial stewardship

Nursing home residents are particularly vulnerable to infections and are often treated with antibiotics. Suspected urinary tract infection (UTI) is the most common reason for antibiotic treatment[1], yet more than half of the treatments may be unnecessary[2]. This highlights the need for interventions that not only support appropriate diagnosis and antibiotic use but also strengthen infection prevention in nursing homes.

The aim of the European IMAGINE project – *Improving antibiotic use in long-term care facilities through infection prevention and control and antimicrobial stewardship* – was therefore to develop, in close collaboration with nursing home staff, a multifaceted intervention suitable for nursing homes across Europe. The intervention was designed to strengthen infection prevention and control (IPC) and antimicrobial stewardship (AMS), ultimately reducing unnecessary antibiotic use by targeting staff in nursing homes across eight European countries: Greece, Hungary, Lithuania, Poland, Slovakia, Slovenia, Spain, and Denmark.

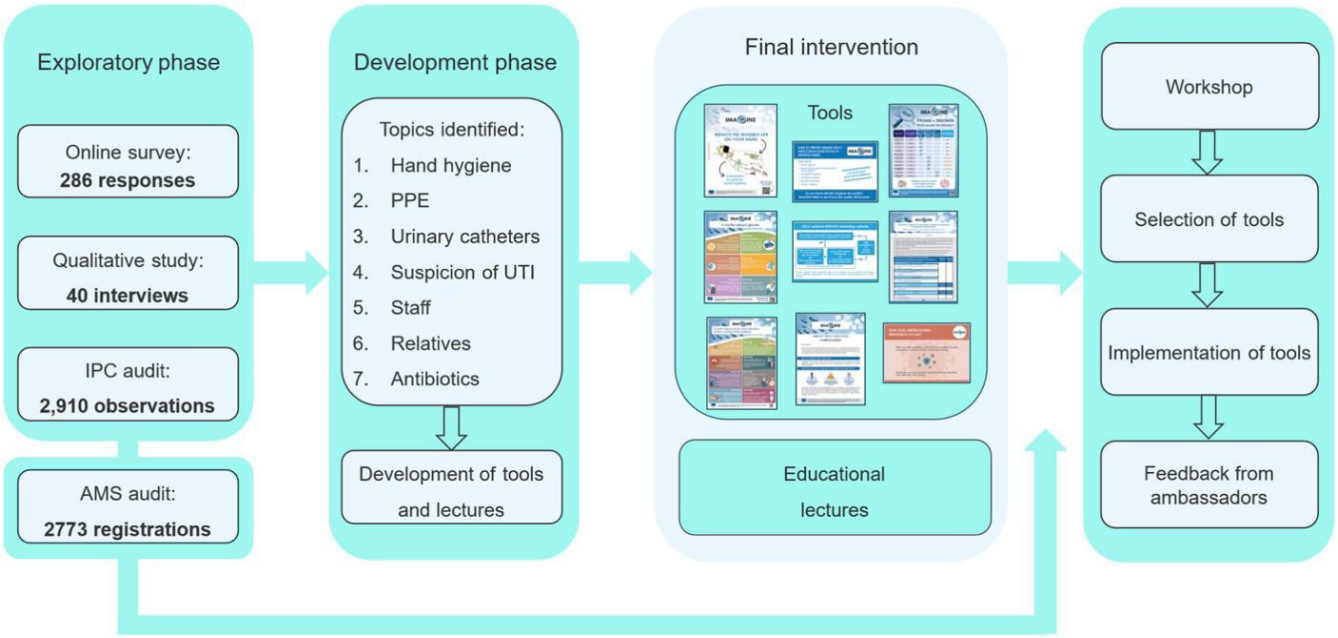
Not just an intervention *for* nursing home staff – but *with* them

A central feature of IMAGINE was the use of Participatory Action Research (PAR). Nursing home staff were recruited as IMAGINE ambassadors and participated as partners throughout the project. They collected audit data, contributed with their knowledge on everyday nursing home practice, participated in workshops and helped implement the intervention locally[3].

The intervention was designed around an exploratory phase. It included an online survey[4], a qualitative study[5], IPC audit, and AMS audit[6] (Figure 1). Data obtained were combined with input from nursing home staff to identify seven priority areas: hand hygiene, personal protective equipment, urinary catheters, suspicion of UTI, staff competences, relatives and antibiotics (Figure 1).

Based on these findings, ten practical tools were developed, ranging from posters and leaflets to an infection prevention quiz, educational material for newly employed staff and a pocket card with an decision algorithm for suspected UTI – (see Figure 1). The intervention also included educational sessions and workshops in each participating country.

Figure 1 Overview of the development and implementation of the IMAGINE intervention DANMAP 2025



Did it make a difference?

A total of 109 nursing homes across the participating countries signed on IMAGINE. 103 completed the project and participated in both the IPC and AMS audits conducted in spring 2024 and repeated one year later in spring 2025.

Overall, adherence improved significantly for 17 of the 29 assessed IPC practices. Improvements were particularly evident for the availability of IPC resources and practices related to the handling of indwelling urinary catheters, although considerable variation was observed between countries[7].

Antibiotic use for suspected UTI also changed. Among residents without an indwelling urinary catheter, the proportion of antibiotic treatments classified as potentially unnecessary decreased from 52.9% before the intervention to 46.1% after the intervention. The overall result, however, conceals considerable variation between countries.

Interestingly, the incidence of antibiotic-treated UTI, across the 103 nursing homes decreased from a mean of 12.2% to 8.9%, corresponding to a relative reduction of approximately 27%. Denmark showed a reduction from 17.0% to 9.7%, corresponding to a 43% reduction[7] (Table 1). In Denmark, this reduction was accompanied by a marked change in diagnostic practice, where the use of urinary dipsticks for suspected UTI decreased by 77%. Changes in antibiotic-treated UTI were smaller in most of the other participating countries, and Slovakia showed an increase.

Table 1 Incidence of antibiotic-treated UTIs during a three-month period among residents at 103 nurs-ing homes in eight European countries before and after the IMAGINE intervention, 2024-2025 DANMAP 2025

Country	Number of residents at participating nursing homes	First registration (2024)	Second registration (2025)	Paired t-test
		Mean UTI incidence (%)	Mean UTI incidence (%)	P-value
Denmark	1,066	17.0	9.7	0.026
Greece	440	17.8	16.0	0.405
Hungary	1,536	11.0	8.3	0.165
Lithuania	779	4.8	3.8	0.546
Poland	1,441	3.7	3.4	0.878
Slovakia	918	4.4	6.8	0.153
Slovenia	2,414	14.3	12.6	0.176
Spain	1,124	26.6	13.3	0.006
Total	9,718	12.2	8.9	0.000

What can we learn from IMAGINE?

The IMAGINE project was based on a before-and-after study without a control group, and the observed changes therefore cannot with certainty be attributed to the intervention. Nor can we determine which of the individual components – audit and feedback, education, practical tools, peer discussion or staff involvement – contributed most to the observed changes.

Nevertheless, the findings suggest an important direction for antimicrobial stewardship in nursing homes. Preventing infections and improving antibiotic use may be most effective when approached together.

One size can fit all

Despite differences in healthcare systems, organization and culture, IMAGINE identified common challenges across the 103 nursing homes, allowing the same core tools to be used in all eight countries – suggesting that sometimes "one size" may actually fit quite many.

continued ... Textbox 5.2

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Textbox 5.3

Free from UTI in the Region of Southern Denmark

An initiative to prevent urinary tract infections among nursing home residents

The aim of this initiative is to reduce the incidence of urinary tract infections (UTIs) among nursing home residents and to reduce antibiotic consumption within the nursing home sector.

Antibiotic consumption is high among Danish nursing home residents compared with other European countries [1]. The majority is prescribed against UTI, though more than half of these treatments may be unnecessary as diagnostic criteria for UTI are not met [2]. There is a great potential for reducing the number of antibiotic prescriptions for nursing home residents and thereby reducing unnecessary adverse effects.

The pilot project

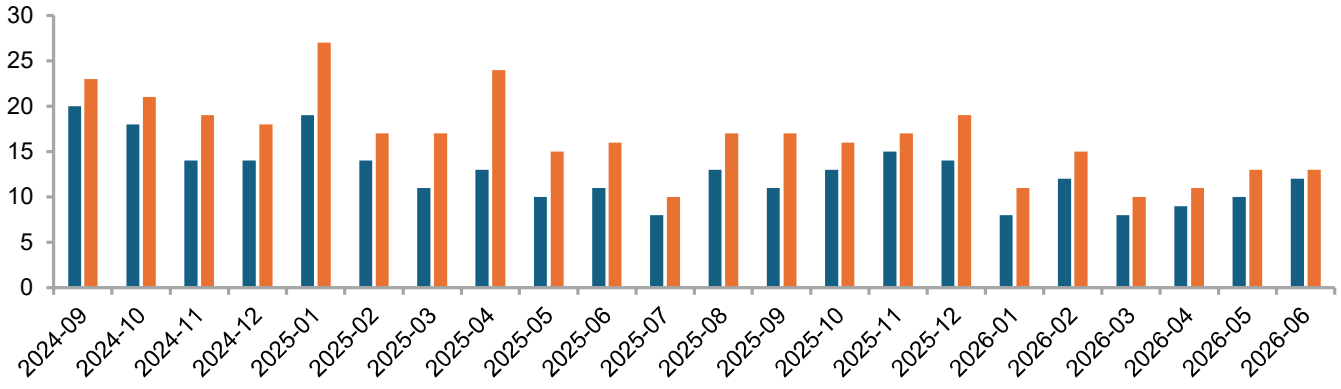
Free from UTI began as a pilot project in 2024 at two selected nursing homes in Nyborg and Odense [3]. Drawing inspiration from other initiatives in Denmark and abroad, the Department of Clinical Microbiology at Odense University Hospital developed a two-hour interactive training seminar in close collaboration with Nyborg and Odense municipalities. This seminar, including short instructional sessions, exercises, and case discussions, was attended by all staff at the two nursing homes. The seminar covered the basics of UTI and antibiotics as well as prevention of UTI and basic hygienic measures. Decision-support tools were developed to assist nursing home staff in assessing residents with suspected UTI. The use of urine dipsticks was discontinued as part of the project.

Both nursing homes succeeded in significantly reducing the incidence of UTIs and antibiotic consumption. One nursing home achieved a 66% reduction in the total number of UTI treatments (from 65 in 2023 to 22 in 2024). The other nursing home achieved a 46% reduction (from 67 in 2024 to 36 in 2025).

Continuation of the project

In 2025, *Free from UTI* was implemented at the remaining public nursing homes in Nyborg and Odense by a "train-the-trainers" method. Key staff members such as specialist nurses, managers, and nursing home doctors were trained to implement *Free from UTI* in their own settings. This effort has been well received in general and antibiotic consumption continues to decline (Figures 1 and 2). Successful implementation of *Free from UTI* principles depends on interdisciplinary collaboration and requires strong leadership commitment. Furthermore, it is essential to have permanent staff members acting as project ambassadors to maintain the effect. The aim is to expand the initiative to nursing homes throughout the Region of Southern Denmark.

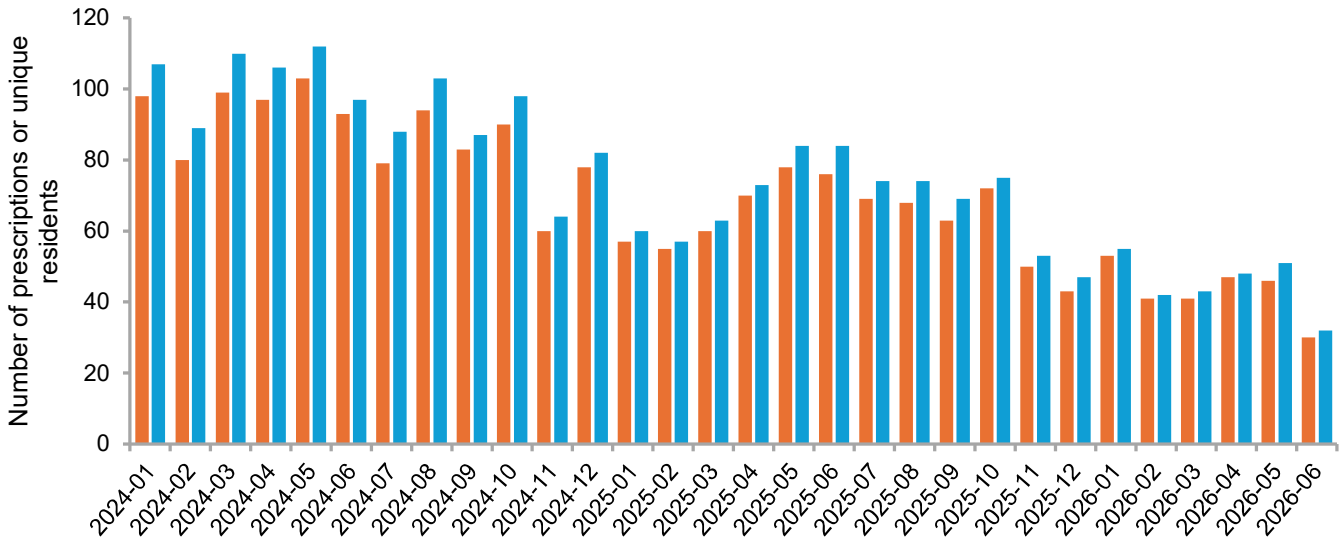
Figure 1 Use of antibiotics against UTI among nursing home residents in Nyborg from September 2024 to June 2026 DANMAP 2025



Number of prescriptions against UTI (orange) and number of unique residents treated against UTI (blue) per month in public nursing homes in Nyborg (approximately 186 residents in total).
The figure is based on cumulated medicine data from the municipality. Data is not adjusted for date of residency; some treatments may have been initiated before moving into the nursing home. Prescriptions of UTI specific antibiotics cover pivmecillinam, trimethoprim, sulfamethizol, or nitrofurantoin.

continued ... Textbox 5.3

Figure 2 Use of antibiotics against UTI among nursing home residents in Odense from January 2024 to June 2026 DANMAP 2025



Number of prescriptions against UTI (orange) and number of unique residents treated against UTI (blue) per month in public nursing homes in Odense (approximately 929 residents in total).
The figure is based on cumulated medicine data from the municipality. Data is not adjusted for date of residency; some treatments may have been initiated before moving into the nursing home. Prescriptions of UTI specific antibiotics cover pivmecillinam, trimethoprim, sulfamethizol, or nitrofurantoin.

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