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Abstract

Antimicrobial Consumption in England, 2017 to 2021 †

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Abstract: The UK's 5-year National Action Plan for Antimicrobial Resistance has an ambition to reduce total antimicrobial consumption, a key driver of antimicrobial resistance, in humans by 15% by 2024, highlighting the need for active surveillance to inform on progression. The English Surveillance Programme for Antimicrobial Utilisation and Resistance (ESPAUR) report, Chapter 3, commentates on key national antimicrobial consumption trends, across primary and secondary care in England, between 2017 to 2021. These findings were presented at the ESPAUR Report webinar on 23 November 2022.

Keywords: antimicrobial consumption; antibiotic; antifungal; England

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1. Introduction

Antimicrobial resistance (AMR) is a recognised global public health threat. Concerns around growing antimicrobial resistance and a dwindling antimicrobial pipeline have placed a focus on AMR at the United Nations General Assembly, and at the G7 and G20 summits [1]. The UK Government has committed to reducing inappropriate antimicrobial consumption, a key driver of resistance, through the National Action Plan; with an ambition to reduce total antimicrobial consumption in humans by 15% by 2024 [2]. In the last seven years, the work of the English Surveillance Programme for Antimicrobial Utilisation and Resistance (ESPAUR), collaborators and stakeholders have supported the ambitions and seen a reduction in total antibiotic use by almost 20%. The ESPAUR report, Chapter 3, commentates on the continued monitoring of trends in antimicrobial usage, over time (including during the COVID-19 pandemic) and across different prescribing settings [3,4].

2. Methods

2.1. Data and Data Sources

Data on the use of antimicrobials (antibiotics, antifungals and antimalarials) were obtained from two main data sources: ePACT2 from the NHS Business Services Authority for antibiotics prescribed in primary care (including NHS dental surgeries), and IQVIA for secondary care. The database held by IQVIA contains data from 99% of NHS hospital pharmacy systems for drugs dispensed to individual patients and wards. Data from all NHS acute Trusts were included.

The covered prescribing settings were general practice (GP), other community settings such as out-of-hours services and walk-in centres, dental practice, and hospital inpatient and outpatient services (ESPAUR Chapter 3 Annexe for further details) [4].

Mid-year populations (inhabitants) were extracted from the Office for National Statistics (ONS). Hospital admission data for each year were extracted from Hospital Episode Statistics (HES) from NHS Digital.

2.2. Data Processing and Statistical Analyses

Depending on the healthcare setting assessed, antimicrobial consumption was measured as items or Defined Daily Doses (DDDs). Rates were calculated as items per 1000 inhabitants per day, or DDDs per 1000 inhabitants per day (DID), or DDDs per 1000 hospital admissions. DDDs were calculated using the Anatomical Therapeutic Chemical/Daily Defined Dose (ATC/DDD) index 2019 managed by the World Health Organisation (WHO). Antibiotic data covered all antibiotics in the ATC group 'J01' ('Antibiotics for systemic use') and additional oral agents used to treat *Clostridium difficile* infections: fidamoxicin (A07AA12), metronidazole (P01AB01), tinidazole (P01AB02) and vancomycin (A07AA09).

Antifungal data covered all antifungals in the ATC group 'J02' ('Antimycotics for systemic use'), and one additional systemic antifungal, terbinafine (D01BA02) [4].

National trends in the consumption of antimicrobials were assessed using linear regression, where the dependent variable was antimicrobial consumption as DID and the explanatory variable was year. STATA version 17 (STATA Corp, College Station, TX, USA) was used to perform the data management and analyses.

3. Results

3.1. Total Antibiotic Consumption

In England, total antibiotic consumption (DDDs per 1000 inhabitants per day [DID]) had been decreasing between 2017 and 2019 (−4.3%, from 18.80 to 17.99 DID), with a sharp and substantial decline seen coinciding with the COVID-19 pandemic (−10.9% between 2019 and 2020 alone), followed by a further 0.5% decline between 2020 to 2021 (from 16.02 to 15.95 DID). This reduction was consistent across all UKHSA centres, regardless of persistent regional variations seen (Figures 1 and 2a). In 2021, the three most commonly prescribed antibiotic groups continued to be penicillins (36.7%), tetracyclines (27.1%) and "macrolides, lincosamides and streptogramins" (13.8%) [4]. Declines seen across all antibiotic groups (apart from oral metronidazole) in 2020 have continued in most antibiotic groups between 2020 and 2021, apart from significant increases noted for penicillins (excluding BLIs), carbapenems, anti-Clostridioides difficile agents, and 'other antibacterials' [4]. Consumption for these classes remained lower than 2019 levels.

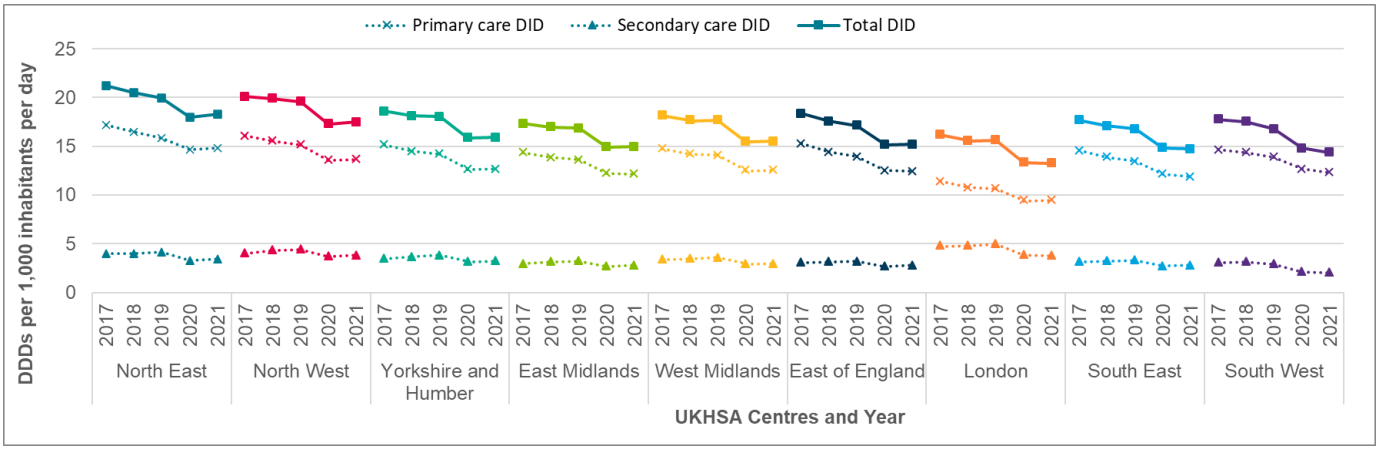

Figure 1. Total, primary and secondary care antibiotic consumption in UKHSA centres, 2017 to 2021 (Excludes dental practice data).

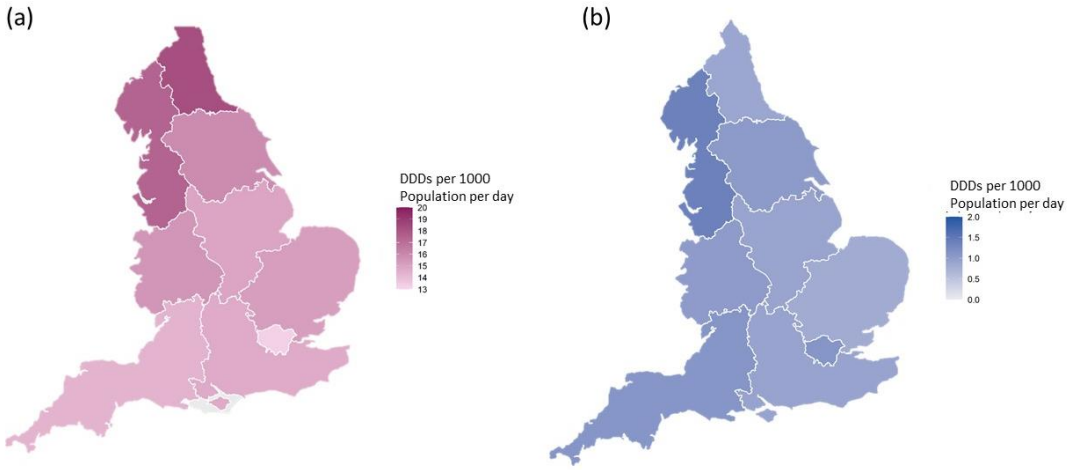

Figure 2. Total consumption of systemic (**a**) antibiotics and (**b**) antifungals across UKHSA centres in England, 2021.

3.1.1. Primary Care Antibiotic Consumption

Across the five years, total and broad-spectrum prescribing rates within primary care continued to decline. Prescribing increases were noted in general practice (0.5%, from 1.245 to 1.251 items per 1000 inhabitants per day) and other community setting prescribing (18%, from 0.081 to 0.096 items per 1000 inhabitants per day) between 2020 and 2021, however, rates remained lower than 2019 [4]. Declines in primary care broad-spectrum antibiotic prescribing rates continued, with a large decrease of 19.8% observed between 2019 and 2020 (0.59 to 0.48 items per 1000 inhabitants per day) and a subsequent increase of 5.6% in 2021 (to 0.50 items per 1000 inhabitants per day), this remaining below 2019 levels [4]. In 2021, the three most predominantly prescribed antibiotic groups in general practices were, as in previous years, penicillins (45.2%), tetracyclines (15.7%), and other antibacterials (15.5%) [4].

From 2017 to 2020 there had been a general decrease in gerenal practice items per 1000 inhabitants per day across all age groups. In 2021, compared with 2020, there were increases amongst the 0–4, 5–14 and 15–64 years age categories (greatest increase amongst 0–4 years: +51.8%, from 0.94 to 1.42 items per 1000 inhabitants per day). This followed a large reduction in prescribing for children aged 0–4 years in 2020 (−39.9%), and is now more in line with 2019 rates. The usage rates in the elderly age groups (65+ years) continued to decrease [4].

Consumption in NHS dental practices, following an unusual 17.6% increase (particulalry in amoxicillin and metronidazole) between 2019 and 2020 (0.13 to 0.15 items per 1000 inhabitants per day), decreased (−7.1%, to 0.14 items per 1000 inhabitants per day in 2021), albietly this was still higher than pre-pandemic levels [4].

3.1.2. Secondary Care Antibiotic Consumption

In 2021, the antibiotic prescribing rate (4372 DDDs per 1000 admissions) in secondary care had decreased by 5.2% compared to 2017, and by 10.4% compared to 2020. There were similar decreases in prescribing rates from 2017 to 2021 across all acute Trust types. In 2020, there were large increases in prescribing rate (DDDs per 1000 admissions) in acute Trusts, likely due to the COVID-19 pandemic, changes in hospital admissions and case-mix of patients (this increased rate masks what was a decline in DDDs during this period and a greater decline in hospital admissions, the denominator), which have since decreased in 2021. Reductions were particularly pronounced among acute large (−16.5% from 2020 to 2021) and acute specialist (−13.7%) Trusts [4].

The antibiotic classes with the highest use in secondary care (comprising approximately one-fifth of prescribing of secondary care antibiotics assessed) in 2021 were ‘penicillins (beta-lactam inhibitor combinations only)’ and ‘penicillins (excluding beta-lactam

inhibitor combinations)' [4]. All antibiotic groups decreased in DDDs per 1000 admissions from 2020 to 2021, except for anti-Clostridioides difficile agents, which increased by 9.2% (5.4 to 5.9 DDDs per 1000 admissions) [4].

According to WHO's Access, Watch and Reserve (AWaRe) categories, adapted to fit England's prescribing environment [5], 'Access' antibiotics were prescribed the most in 2021 (53.1% out of the total DDDs per 1000 admissions), followed by 'Watch' (45.3%) and 'Reserve' (3.1%). These percentages are similar to previous years [4].

3.2. Antifungal Consumption

Total antifungal consumption (primary and secondary care) increased by 7.1% to 1.03 DID from 2020 to 2021, this was still lower than in 2017 by 22.9%. Systemic antifungal use is mostly driven by use in primary care, with 87% of prescribing taking place in this setting in 2021 (0.9 DID). There was a 25.4% decrease in primary care antifungal use from the rate in 2017, but a 6.9% increase from 2020. In secondary care the rate of prescribing was 191 DDDs per 1000 admissions in 2021, representing a 7.1% increase from 2017, but a 4.5% decrease from the rate in 2020 [4].

In 2021, the North West had the highest total antifungal prescribing rate (1.37 DID), whilst the East of England had the lowest (0.81 DID) (Figure 2b). Terbinafine had the highest rate of antifungal prescribing in primary care (2021: 0.67 DID), whilst fluconazole was the highest in secondary care (2021: 67 DDDs per 1000 admissions per day).

4. Discussion

Continued declines in total antibiotic consumption were observed, with a sharp decline between 2019 and 2020 (10.9%), and a slighter decrease of 0.5% between 2020 and 2021. In addition to improvements in antimicrobial stewardship and progress towards the NAP targets, this decreasing trend highlights the impact that the COVID-19 pandemic has had on antimicrobial consumption in England. The most recent 2021 data suggest that this may not be a sustained change [4]. The largest reductions in antibiotic prescribing have consistently been within the GP setting, which is also the setting in which the highest level of antibiotic consumption occurs [4]. The large reductions in prescribing in 2020 in the 0–4 year old patients are likely related to reduced respiratory antibiotic prescribing in the young [6] and reduced general practice consultations [7] related to national COVID-19 prevention measures. Following this steep reduction, in 2021, there were increases amongst the younger age groups (greatest amongst 0–4 years old; +51.7%) and is more in line with 2019 rates [4]. Despite improved infection prevention measures by health care professionals and general population alike and changes in service delivery (fewer face-to-face consultations in primary care and less hospital admissions, particularly during the first year of the COVID-19 pandemic), there were other factors which would have altered prescribing needs and behaviours, such as; social restrictions encouraged through national and regional 'lock-down' measures (increased household spread of infections), wearing of masks impacting circulation of pathogens, and changes in the case mix of patients consulting in primary care (reduction in appointments for the very young) as well as those admitted into hospital (with delayed and cancelled elective procedures and increases in more acutely ill patients and admissions to intensive care and high dependency units). With services beginning to resume, consumption trends are somewhat changing to reflect this in 2021 [4].

COVID-19 restrictions and reduced access to dentistry in England had the opposing impact on antibiotic prescribing trends to other primary care settings, with published literature also demonstrating unprecedented increases in this setting between 2019 and 2020, which are now beginning to reduce [8].

Across settings, significant increases were noted for penicillins (excluding BLIs), carbapenems, anti-*Clostridioides difficile* agents, and 'other antibacterials' between 2020 and 2021 [4]. During this same period, secondary care use reduced across all antibiotic groups, except for anti-*Clostridioides difficile.* The increase in carbapenems is likely related to their

inclusion within national guidelines [4,9,10]. Increased use in anti-*Clostridioides difficile* agents may be related to noted increases in hospital-onset *Clostridioides difficile* infections reported [4,11].

Total antifungal consumption did not demonstrate a decrease between 2020 and 2021 as was seen with antibiotic use. While it is not possible to further describe these trends without indication data, the literature reports antifungal agents have been administered as prophylaxis or combination therapy among COVID-19 patients [12]. This may be related to the increasing prevalence of invasive fungal infections (usually acquired by immunocompromised patients in hospitals and in the ICU settings) [4].

5. Conclusions

The UKHSA continues to work alongside key stakeholders to bring together relevant information to inform on trends and the impact of various factors on antimicrobial prescribing, and progress towards the NAP. Improvements and reductions in prescribing have been made, although we are seeing increases in consumption returning towards pre-pandemic levels since healthcare services have resumed activities. Continued stewardship and surveillance are therefore needed for sustained progress in reducing antimicrobial consumption as systems continue to recover from the COVID-19 pandemic.

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