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Reducing inappropriate prescribing of antibiotics in English primary care: evidence and outlook

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Antibiotics are indispensable for treating bacterial infections, but their effectiveness is threatened by the emergence and spread of antibacterial resistance. Antibiotics are unique among drugs since the more they are used, the less effective they become because bacterial resistance is likely to develop. In response to this threat, the UK government aims to reduce inappropriate antibiotic prescribing in humans by 50% by 2020. A team at Public Health England has found that at least 20% of antibiotic prescriptions in primary care in England were inappropriate, which, if correct, implies that antibiotic prescribing nationally needs to be reduced by 10% by 2020. These data are published in five articles in a Supplement to *JAC* entitled *Appropriateness of antibiotic prescribing in English primary care*. Inappropriate prescribing was found in every general practice included in the analyses so each one should attempt to reduce unnecessary prescriptions, not just high-prescribing practices. An ambition of 10% reduction in antibiotic prescriptions seems attainable when compared with the reduction targets of other European countries. The need for substantial improvements in data quality that are necessary to further safeguard this precious resource is also highlighted by the authors in this Supplement.

Antibiotics are a pillar of modern medicine, having saved millions of lives since mass production of penicillin began in the 1940s.[1] Yet the effectiveness of antimicrobial treatments is threatened by the increasing global prevalence of resistant pathogens, particularly those that are resistant to several antimicrobials, as well as the insufficient rate of development of new antimicrobial agents. According to the Independent Antimicrobial Resistance Review, led by Jim O'Neill, >700 000 people across the globe die every year due to infections caused by resistant microorganisms and this may well reach 10 million per year by 2050.[2] This is not only a health issue, it is also an economic one the effect of which is predicted to be greater than that of the 2008–09 global financial crisis and will likely have a negative impact on attaining the Sustainable Development Goals Agenda by 2030. According to predictions in the World Bank's report, a 1.1%–3.8% decline in GDP by 2050, with annual shortfalls exceeding US$1 trillion to US$3.4 trillion per year by 2030, will occur if appropriate action is not taken.[3] As microorganisms do not respect borders, we can only tackle this if every country and sector plays its part in full.

In response to this grave global threat, four ambitions are part of the UK government's commitments: (i) halving inappropriate antibiotic prescribing in humans by 2020; (ii) halving the number of healthcare-associated bloodstream infections caused by Gram-negative bacteria; (iii) reducing antibiotic use in animals; and (iv) incentivizing the development of new antibiotics.[4] Clear definitions of what is appropriate and inappropriate antibiotic prescribing are a prerequisite for meeting the first aim as well as generating a plausible estimate of the magnitude of inappropriate prescribing. To this end, researchers at PHE have published a series of papers in a Supplement to this Journal entitled *Appropriateness of antibiotic prescribing in English primary care*, which aims to quantify the extent of inappropriate prescribing in English primary care so as to inform, and adjust where necessary, government reduction targets.[5–9]

Smieszek *et al.*[9] used patient data from a large primary care database to evaluate inappropriate antibiotic prescribing in English general practice. A large share of prescribing could not be assessed owing to poor coding of diagnoses, making it impossible to determine why the antibiotic was prescribed. Yet, even using conservative assumptions, they identified between 8.8% and 23.1% of all systemic antibiotic prescriptions in English primary care as inappropriate, i.e. 'any antibiotic prescribing that is likely to have marginal, if any, patient benefit', ignoring inappropriate choice of drug, dosage or treatment duration.[9] The findings were discussed at a joint PHE/Department of Health workshop that included delegates from primary and secondary care and a consensus was reached that at least 20% of antibiotic prescriptions were currently inappropriate.[10] This implies that primary care in England should reduce the total antibiotic prescribing by at least 10% by 2020/21 to meet the government's ambition of halving inappropriate prescribing.

Practices varied in their level of inappropriate prescribing; however, *every* practice included in the PHE analyses prescribed at least some antibiotics inappropriately,[9] suggesting that efforts to reduce unnecessary antibiotic prescriptions should be made throughout primary care and not focus solely on practices with high prescribing rates. At the same time, differences between practices in patient populations, such as the proportion of those with comorbidities, only explained a small fraction of the variation

in prescribing rates; instead, consultation rates for respiratory tract infections were identified as a main driver.[8] Hence, the authors concluded there was no need to adjust targets according to particular patient populations as the variation in antibiotic prescribing rates is probably mostly driven by behavioural factors rather than differing medical needs.

The UK ranked 14th among the 29 countries that reported data on antibiotic consumption in primary care to the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) in 2016, with 19.6 DDDs per 1000 inhabitants per day (DID).[11] Although UK antibiotic consumption per inhabitant was only about half that of the highest-consuming country (Greece, at 36.3 DID), it was nearly double the lowest-consuming country in Europe (The Netherlands, at 10.2 DID).[11] Comparing countries' health systems in a fair manner is difficult, but the fact that the UK consumes 1.9 times as many antibiotics in primary care as the Netherlands—a country with similar climate, demographics and wealth—indicates overuse in the UK and suggests that a 20% rate of inappropriate prescribing is likely to be a conservative estimate.

The pace of the suggested changes for England (10% reduction of antibiotic prescriptions in primary care by 2020) seems sensible—though cautious—in the context of other countries' prescribing levels. A recent study has listed current targets for antibiotic prescribing of 23 European and 16 non-European countries,[12] with Belgium aiming to reduce the number of prescriptions by at least 25% by 2020 (from >800 to 600 prescriptions per 1000 inhabitants) and by >50% by 2025 (400 per 1000 inhabitants). Norway aims to reduce the number of antibiotic prescriptions from 450 to 250 per 1000 inhabitants by 2020 (in comparison, Dolk *et al.*[5] reported 607 prescriptions per 1000 registered English patients for 2015).

One substantial barrier to quantifying inappropriate prescribing in English primary care was poor diagnostic coding: 31% of all prescriptions could not be linked to an informative diagnostic code.[5] We clearly need improved documentation of why antibiotics are, or indeed are not, prescribed in order to quantify inappropriate prescribing and gain a deeper understanding of prescribing behaviour. This requires consistent use of a single set of definitions and coding in electronic prescribing systems across the NHS. A second challenge is understanding the appropriateness of a given antibiotic for the increasing number of patients with multiple morbidities. The PHE analyses focused on common conditions and patients without comorbidities[9] but further research is clearly needed to optimize the management of complex patients who currently receive repeated or long-term treatment with antibiotics. A substantial proportion of prescriptions is issued to these patients[5] and they are more likely to suffer from complications due to antibacterial resistance. Finally, relevant figures on inappropriate antibiotic prescribing are inevitably of a transient nature. The development and implementation of inexpensive and reliable point-of-care tests and much-needed diagnostic tools when incorporated into evidence-based clinical assessment pathways should allow prescribers to identify those patients most likely to benefit from antibiotic treatment with greater certainty while reducing so-called 'empirical' or 'just in case' prescribing. At the same time, an ageing society will inevitably lead to an increased number of patients with one or more comorbidities. This will necessitate the use of a range of strategies to prevent infectious diseases and reduce their burden, and may actually lead to higher antibiotic prescribing rates than would be necessary in a younger and healthier society. Therefore, efforts to optimize antibiotic prescribing, monitor changes in prescribing patterns, and implement early warning systems to detect unintended developments should be continued now and in the future.

Transparency declarations

None to declare.

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