Antibiotics prescribing and antimicrobial resistance patterns in Britain

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Antibiotic resistance is a complex problem – overuse and misuse of antibiotics is creating antibiotic-resistant strains of bacteria against which none of our current antibiotics work. As resistance spreads to new regions, bacteria and drugs, public health authorities warn that we could face a future in which antibiotics no longer work limiting treatments of infectious diseases and wounds, as well as surgical operations that use the available antibiotics. Alongside growing efforts to develop new treatments and diagnostics, public health authorities worldwide are engaged in local and global campaigns to limit antibiotic prescription by clinicians and demand by patients. The monitoring of antibiotic prescribing (AB) as well as cases of antimicrobial resistance (AMR) is a key component of these campaigns.

The UK Five Year AMR Strategy was launched by the government in September 2013. In addition to stimulating the development of new treatments and diagnostics and novel therapies, the strategy included the improvement of the knowledge and understanding of AMR, and efforts to conserve and steward the effectiveness of existing antibiotics. The strategy’s impact on reducing the level of inappropriate antibiotic use is assessed by measurements of changes in total prescribing and the prescribing of antibiotics from special classes. These measurements are based on records of prescriptions obtained from hospitals and surgeries that are then weighed by population size, and composition in terms of age and gender (STAR PU). This project explores data stored by Public Health England (PHE) to explore regional patterns, prevalence of diseases, social demographics and other factors that may influence prescribing practices.

PHE, who recently launched their “Keep Antibiotics Working” campaign (October 2017) warns that 5,000 deaths are caused every year in England because antibiotics no longer work for some infections. PHE and other organizations have already set up dashboards to monitor prescribing measures. I hope that I can offer some contribution and support to generating useful insights from the data amassed. The first outcome of this study, loaded as a Tableau story, is an estimation and visualization of the reduction in antibiotic prescribing in the years 2014-2017. By examining data aggregated at the regional level (207 Clinical Commissioning Groups(CCGs)) the study finds a general trend towards reducing prescribing though mostly at the level of 10-15%. The dashboard produced maps and tabulates reduction levels in different regions, and how these changes fare in relation to targets set by the National Health Service.

Data

AMR Local Indicators (<https://fingertips.phe.org.uk/profile/amr-local-indicators>).

Tools

Data access: fingertips library (R).

Data wrangling and analysis: Python (pandas, numpy)

Visualization: Tableau, Python (seaborn, plotly)

**Key sources**

*Indicators and monitoring*

Johnson, A. P. *et al.* Improving feedback of surveillance data on antimicrobial consumption, resistance and stewardship in England: putting the data at your Fingertips. *Journal of Antimicrobial Chemotherapy* **72**, 953-956, doi:10.1093/jac/dkw536 (2017).

Department of Health. UK 5 Year Antimicrobial Resistance (AMR) Strategy 2013-2018 - Measuring success. (2014).

Beech, E. Introduction to the antibiotic Quality Premium. (NHS, 2015).

PrescQipp, a Non-profit supporting NHS prescribing policies holds an extensive repository of documents and links related to AMR:

<https://www.prescqipp.info/antimicrobial-stewardship/projects/antimicrobial-stewardship>

*Implementation studies*

HM Government. UK 5 Year Antimicrobial Resistance (AMR) Strategy 2013–2018: Annual progress report and implementation plan (2014).

Susan, H. UK initiatives to reduce antimicrobial resistant infections, 2013-2018. *International Journal of Health Governance* **21**, 131-138, doi:doi:10.1108/IJHG-02-2016-0013 (2016).

Islam, J. *et al.* A national quality incentive scheme to reduce antibiotic overuse in hospitals: evaluation of perceptions and impact. *Journal of Antimicrobial Chemotherapy* **73**, 1708-1713, doi:10.1093/jac/dky041 (2018).

Currie, C. J. *et al.* Antibiotic treatment failure in four common infections in UK primary care 1991-2012: longitudinal analysis. *British Medical Journal* **349**, doi:10.1136/bmj.g5493 (2014).

Dolk, F. C. K., Pouwels, K. B., Smith, D. R. M., Robotham, J. V. & Smieszek, T. Antibiotics in primary care in England: which antibiotics are prescribed and for which conditions? *Journal of Antimicrobial Chemotherapy* **73**, ii2-ii10, doi:10.1093/jac/dkx504 (2018).

**Data and dashboards**

AMR local indicators, Public Health Engalnd,

<https://fingertips.phe.org.uk/profile/amr-local-indicators/data#page/4/gid/1938132909/pat/46/par/E39000030/ati/152/are/E38000010>

Visual snapshot AMS, PrescQipp

<https://www.prescqipp.info/pqva/visual-snapshot-ams>

Medicines Optimization Dashboard, NHS

<https://apps.nhsbsa.nhs.uk/MOD/AtlasCCGMedsOp/atlas.html>

Heat map infographics, Antibiotic Research UK

<https://www.antibioticresearch.org.uk/antibiotic-prescribing-heat-map-infographic-published-all-over-the-uk/>