

Environmental Impact of COVID-19 and Effects of Changing Behaviours

Andrew C. Singer

UK Centre for Ecology & Hydrology

Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria (PACCARB)

1:20pm, September 10, 2020

18,455

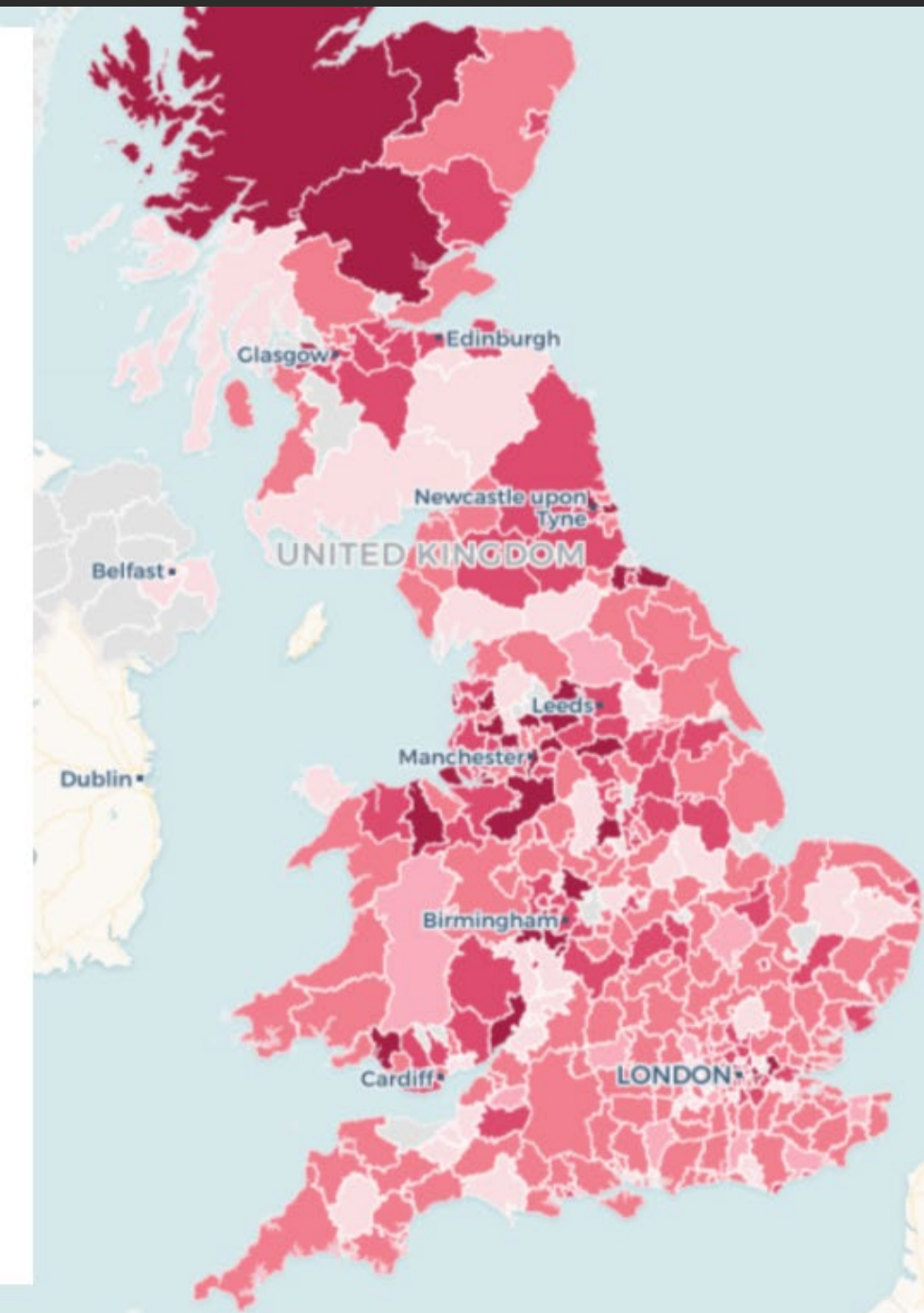
people are currently predicted to have symptomatic COVID in the UK

Estimated cases per million

- Not enough data
- 0 - 50 cases pm
- 50 - 100 cases pm
- 100 - 500 cases pm
- 500 - 1000 cases pm
- 1000 - 5000 cases pm

*Aged 20-69

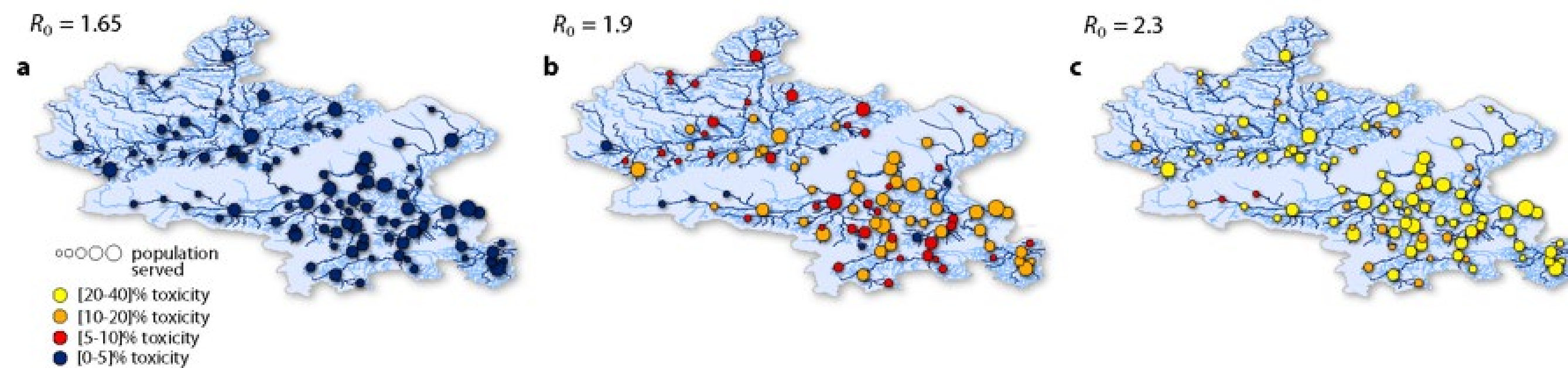
Last update: 22 of August, 5:00am BST



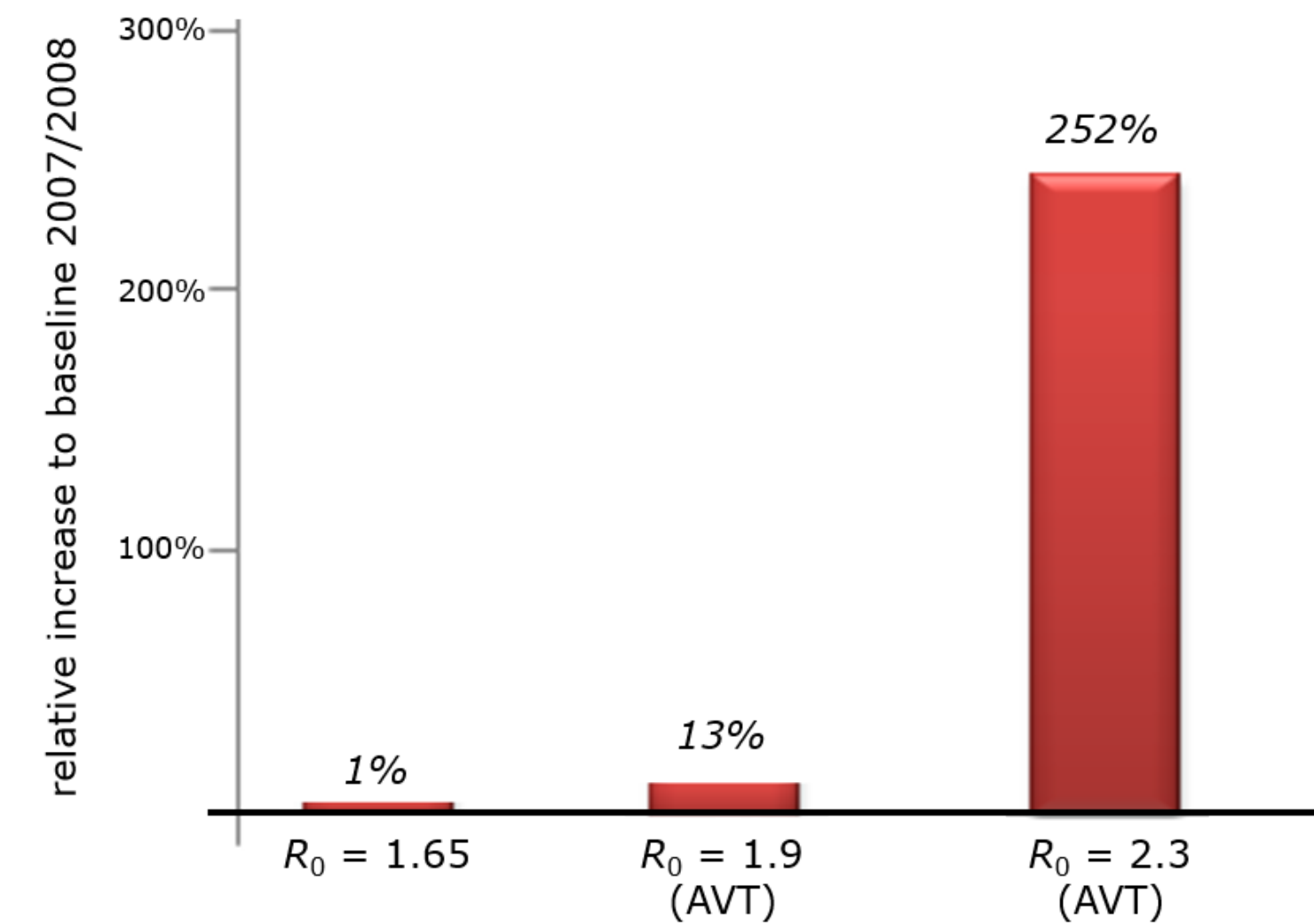
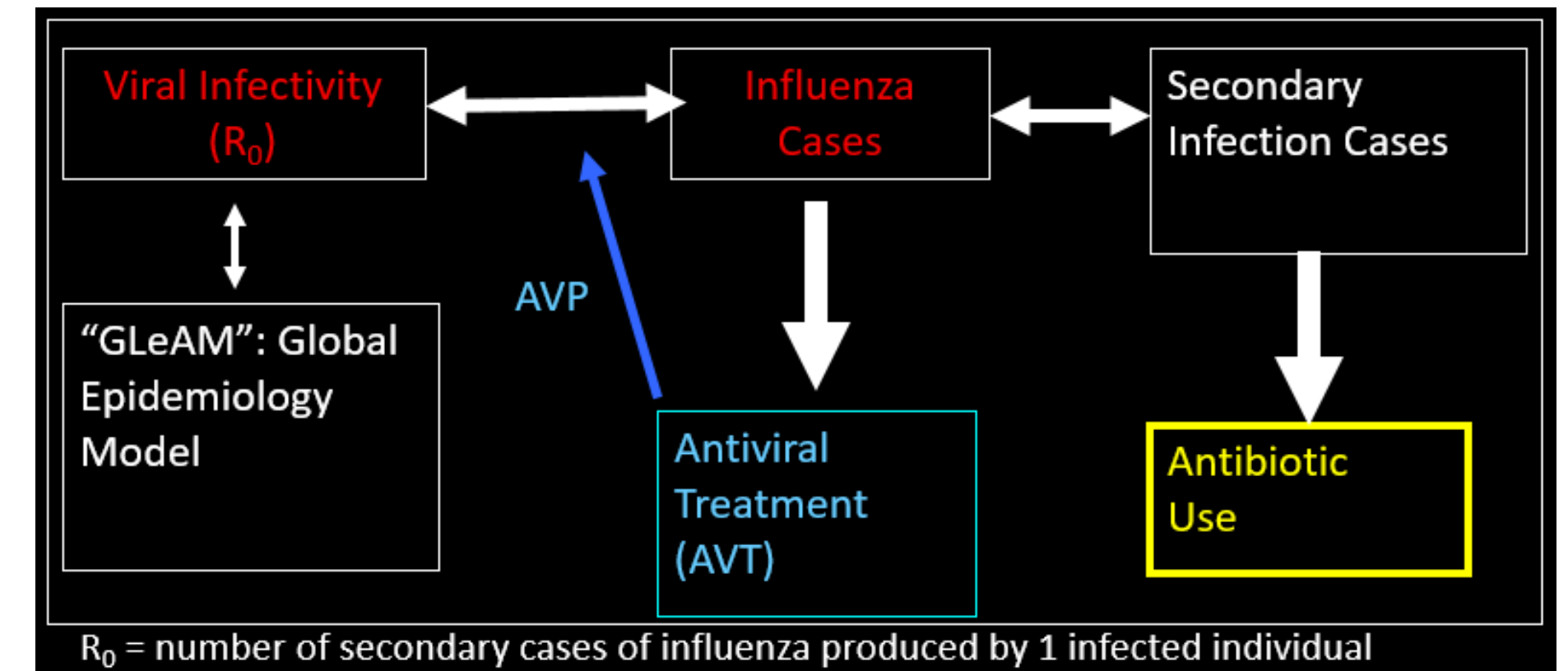
Environmental Impact of a Medical Response to a Pandemic

A moderate to severe influenza pandemic will increase antibiotic use (13 to 252%), risking:

- Reduction in sewage treatment
- Reduced pathogen removal
- Untreated sewage discharge
- AMR selection in STP & environment



<https://ehp.niehs.nih.gov/doi/10.1289/ehp.1002757>



Antimicrobial Use during COVID-19 Pandemic

| Table 1 Antibiotics for people 18 and older with suspected community-acquired pneumonia | |
|---|---|
| Empirical treatment | Antibiotics and dosage (oral doses are for immediate-release medicines) |
| Oral antibiotics for moderate or severe pneumonia | <p>Options include:</p> <p>Doxycycline: 200 mg on first day, then 100 mg once a day</p> <p>Co-amoxiclav: 500 mg/125 mg three times a day <u>with</u> Clarithromycin: 500 mg twice a day</p> <p>In severe pneumonia, and if the other options are unsuitable:</p> <p>Levofloxacin: 500 mg once or twice a day (consider the safety issues with fluoroquinolones)</p> |
| Intravenous antibiotics for moderate or severe pneumonia | <p>Options include:</p> <p>Co-amoxiclav: 1.2 g three times a day <u>with</u> Clarithromycin: 500 mg twice a day</p> <p>Cefuroxime: 750 mg three or four times a day (increased to 1.5 g three times a day if infection is severe) <u>with</u> Clarithromycin: 500 mg twice a day</p> <p>In severe pneumonia, and if the other options are unsuitable:</p> <p>Levofloxacin: 500 mg once or twice a day (consider the safety issues with fluoroquinolones)</p> |

There are no validated tools to assess the severity of community-acquired pneumonia in the context of the COVID-19 pandemic; severity should be based on clinical judgement.

NICE National Institute for Health and Care Excellence

Secondary Bacterial Infections from COVID-19

Patients with suspected community-acquired pneumonia are to be treated with:

- Doxycycline
- Co-amoxiclav
- Clarithromycin
- Cefuroxime
- Levofloxacin

Evidence of Antibiotic Use

Clinical Infectious Diseases

MAJOR ARTICLE



Bacterial and Fungal Coinfection in Individuals With Coronavirus: A Rapid Review To Support COVID-19 Antimicrobial Prescribing

Timothy M. Rawson,^{1,2,3} Luke S. P. Moore,^{1,4,5} Nina Zhu,¹ Nishanth Ranganathan,^{3,4} Keira Skolimowska,^{3,4} Mark Gilchrist,^{3,4} Giovanni Satta,^{3,4} Graham Cooke,^{3,4} and Alison Holmes^{1,2,3,4}

¹National Institute for Health Research, Health Protection Research Unit in Healthcare Associated Infections and Antimicrobial Resistance, Imperial College London, London, United Kingdom,

²Centre for Antimicrobial Optimisation, Imperial College London, London, United Kingdom, ³Department of Infectious Diseases, Imperial College London, South Kensington, United Kingdom,

⁴Imperial College Healthcare NHS Trust, Hammersmith Hospital, London, United Kingdom, and ⁵Chelsea & Westminster NHS Foundation Trust, London, United Kingdom

Background. To explore and describe the current literature surrounding bacterial/fungal coinfection in patients with coronavirus infection.

Methods. MEDLINE, EMBASE, and Web of Science were searched using broad-based search criteria relating to coronavirus and bacterial coinfection. Articles presenting clinical data for patients with coronavirus infection (defined as SARS-1, MERS, SARS-CoV-2, and other coronavirus) and bacterial/fungal coinfection reported in English, Mandarin, or Italian were included. Data describing bacterial/fungal coinfections, treatments, and outcomes were extracted. Secondary analysis of studies reporting antimicrobial prescribing in SARS-CoV-2 even in absence of coinfection was performed.

Results. 1007 abstracts were identified. Eighteen full texts reporting bacterial/fungal coinfection were included. Most studies did not identify or report bacterial/fungal coinfection (85/140; 61%). Nine of 18 (50%) studies reported on COVID-19, 5/18 (28%) on SARS-1, 1/18 (6%) on MERS, and 3/18 (17%) on other coronaviruses. For COVID-19, 62/806 (8%) patients were reported as experiencing bacterial/fungal coinfection during hospital admission. Secondary analysis demonstrated wide use of broad-spectrum antibacterials, despite a paucity of evidence for bacterial coinfection. On secondary analysis, 1450/2010 (72%) of patients reported received antimicrobial therapy. No antimicrobial stewardship interventions were described. For non-COVID-19 cases, bacterial/fungal coinfection was reported in 89/815 (11%) of patients. Broad-spectrum antibiotic use was reported.

Conclusions. Despite frequent prescription of broad-spectrum empirical antimicrobials in patients with coronavirus-associated respiratory infections, there is a paucity of data to support the association with respiratory bacterial/fungal coinfection. Generation of prospective evidence to support development of antimicrobial policy and appropriate stewardship interventions specific for the COVID-19 pandemic is urgently required.

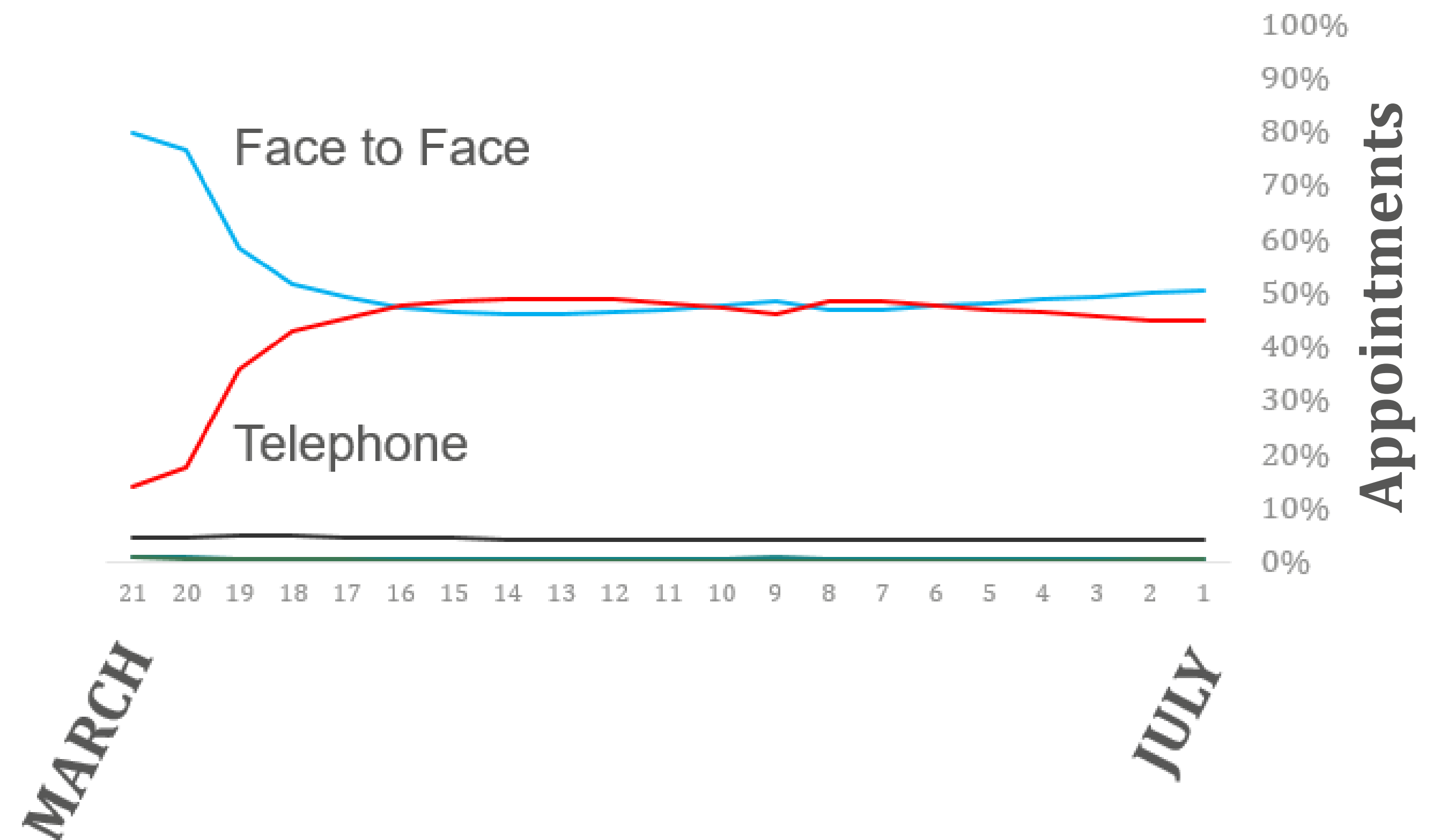
Keywords. SARS-CoV-2; antimicrobial stewardship; antimicrobial resistance.

- 8% of COVID-19 patients reported bacterial/fungal coinfection during hospital admission.
- 72% of COVID-19 patients reported received antimicrobial therapy.



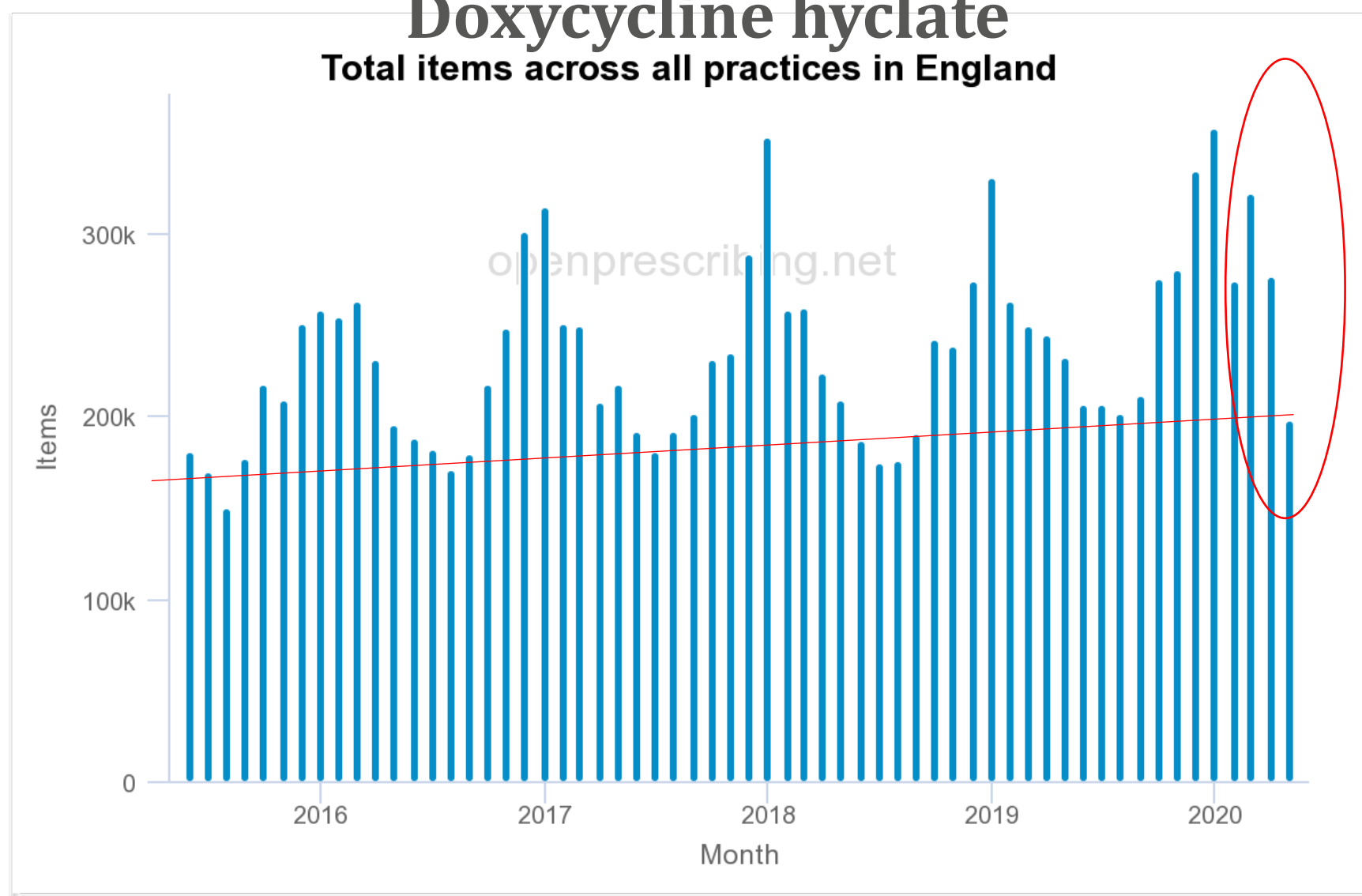
Impact of COVID-19 on Access to Healthcare

1. Reduced 'Face to Face' visits to the doctor might have resulted in reduced antibiotic prescribing.
2. Is a similar trend seen in countries where access to antibiotics is typically provided without a prescription (LMICs).

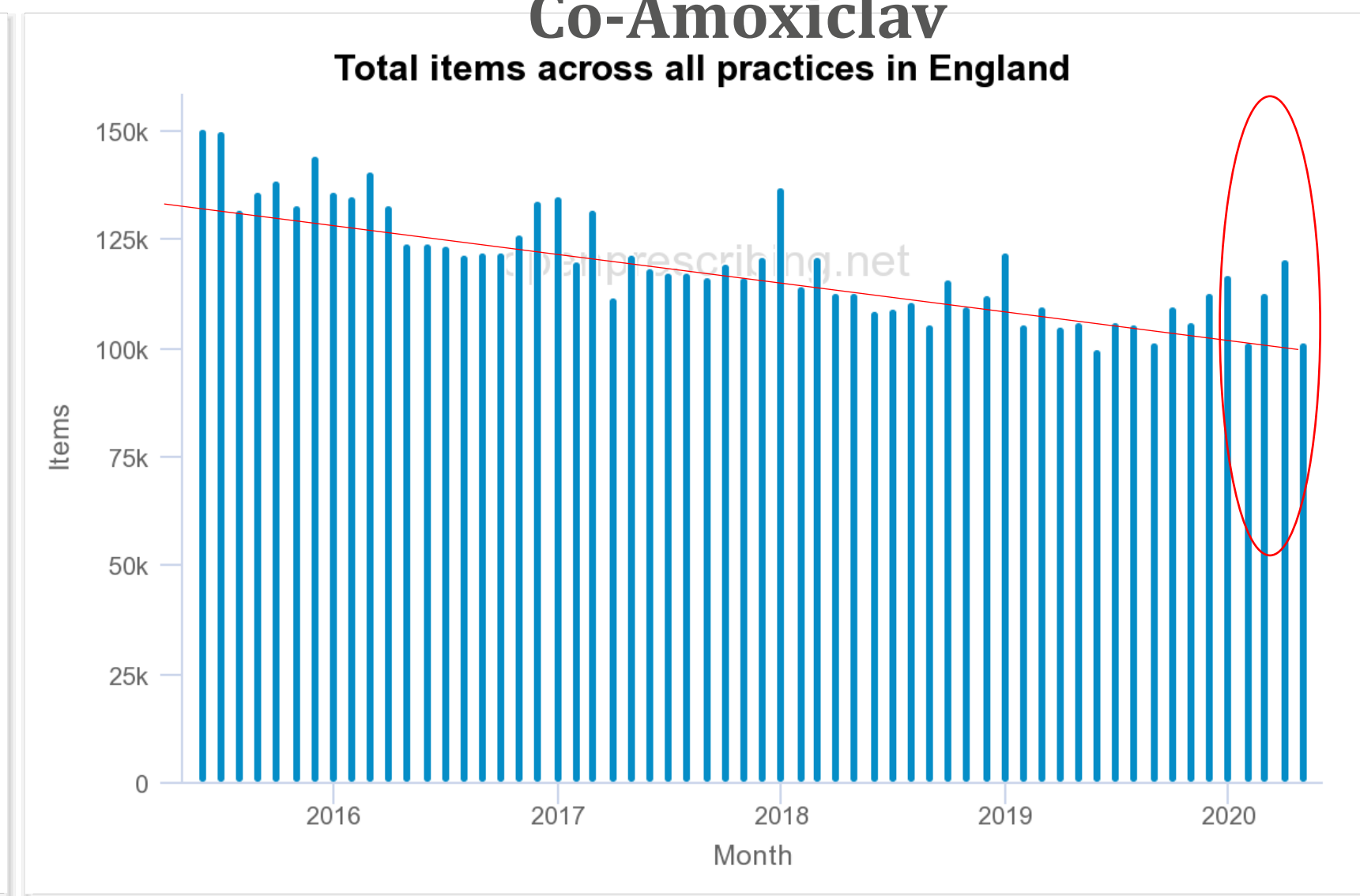


Evidence for Increased Antibiotic Use by NHS

Doxycycline hyclate
Total items across all practices in England

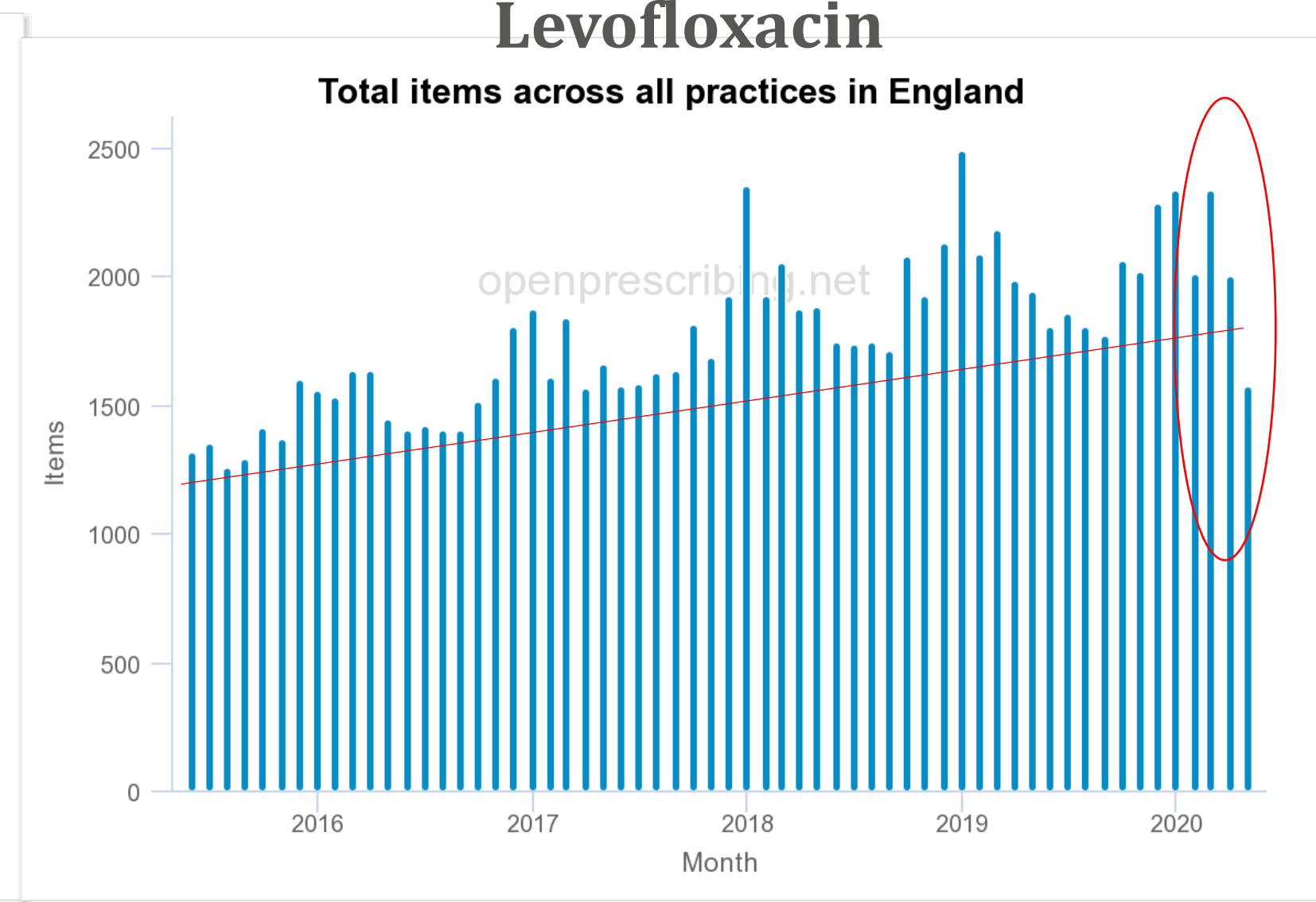


Co-Amoxiclav
Total items across all practices in England

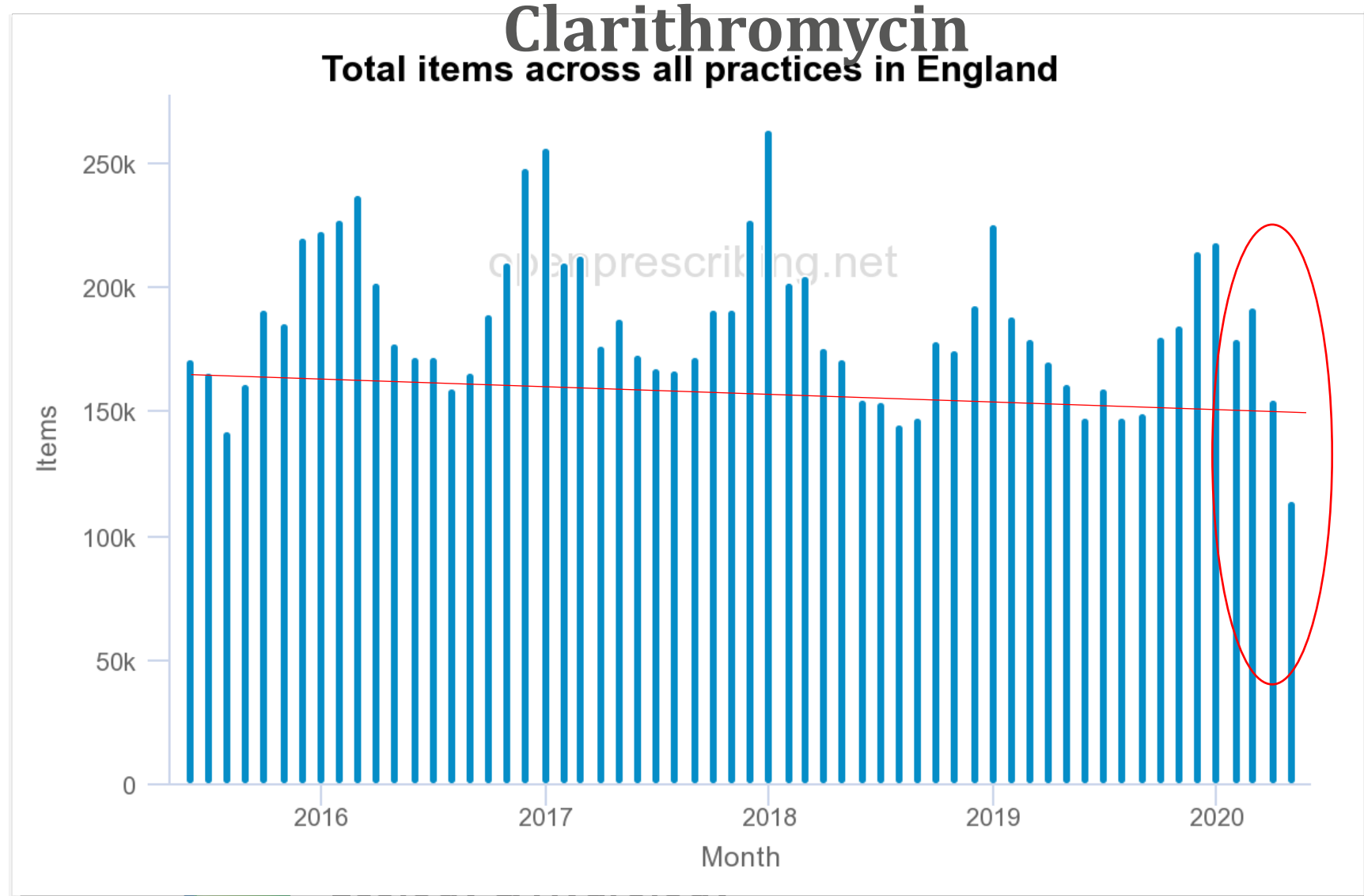


Levofloxacin

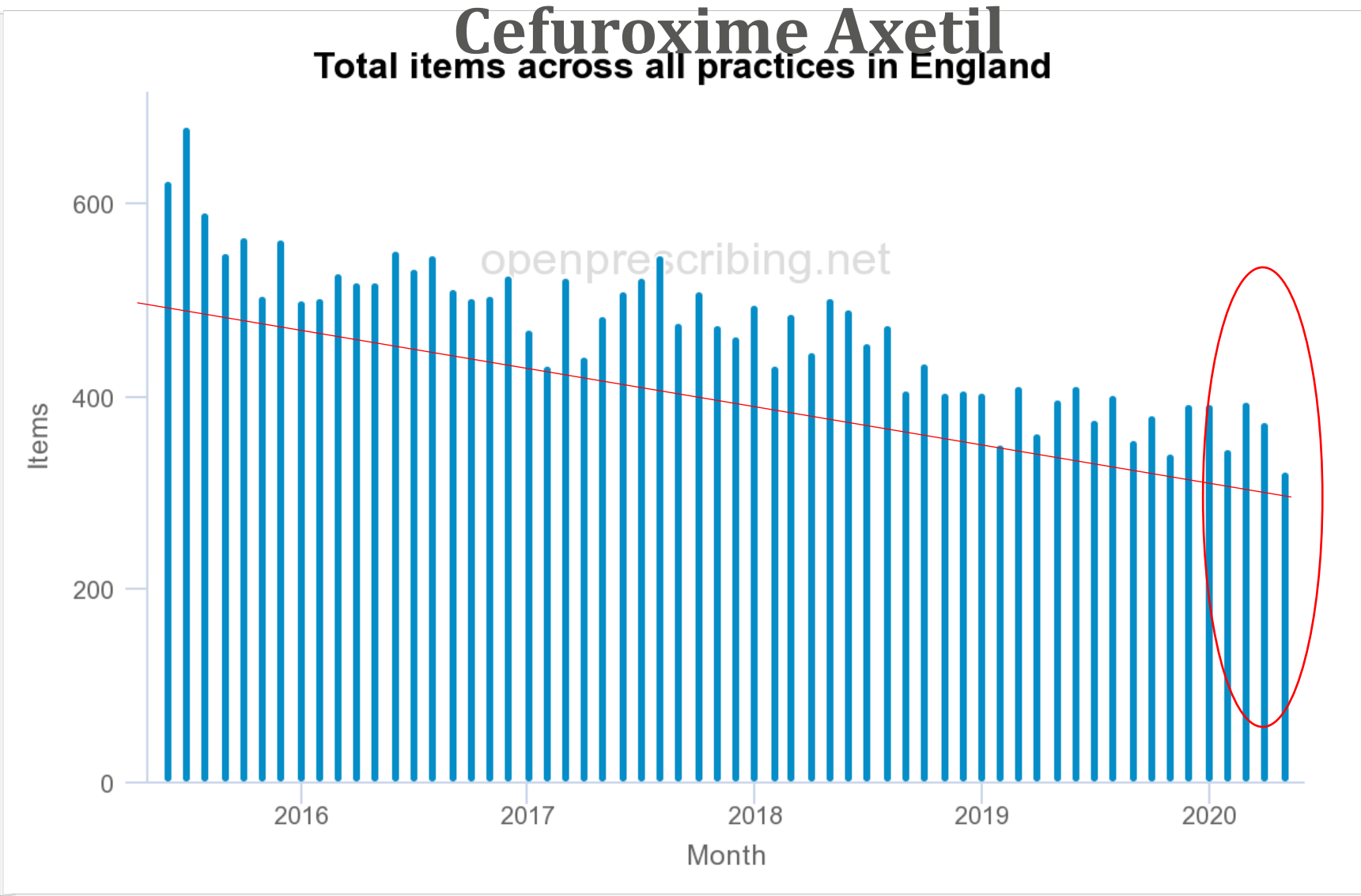
Total items across all practices in England



Clarithromycin
Total items across all practices in England



Cefuroxime Axetil
Total items across all practices in England



**Early pandemic (<May):
increased antibiotic use**

**Lockdown led to lower
antibiotic use (at a
national level).**

Behaviour Change: Environmental Surveillance

Lockdown reduced environmental surveillance compromising incident identification, mitigation, enforcement.

More 'stay-cations' means increased use of local sewage-impacted rivers with implications on AMR carriage/infection.



Exclusive: water firms discharged raw sewage into England's rivers 200,000 times in 2019

Untreated effluent flowed into waterways for more than 1.5m hours, data shows

Sandra Laville and Niamh McIntyre

Wed 1 Jul 2020 15:00 BST

● **England's privatised water firms paid £57bn in dividends since 1991**



Water companies in England discharged raw sewage into rivers on more than 200,000 occasions last year, according to data obtained by the Guardian.

The analysis reveals untreated human waste was released into streams and rivers for more than 1.5m hours in 2019.

The figures, obtained via environmental information requests, trace releases of sewage from storm drains in rivers across England by all nine water companies and provide a comprehensive picture of the scale of pollution from what critics say is the routine dumping of untreated sewage.

<https://www.theguardian.com/environment/2020/jul/01/water-firms-raw-sewage-england-rivers>

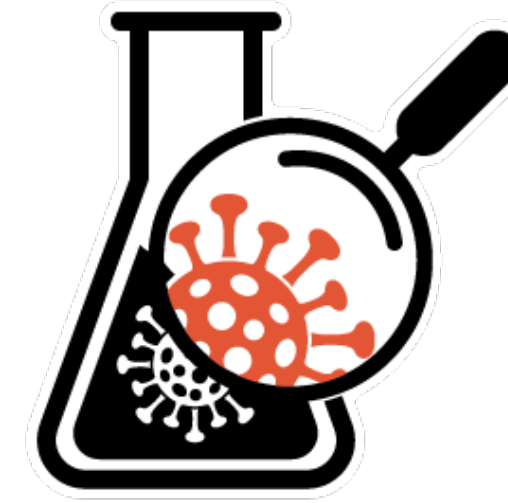
Behaviour Change: Academia

Many within the AMR research community have adapted to the needs for COVID-19 research.

- leaves us unaware of the unique impact of COVID-19 on AMR the environment.
- Reduced availability of molecular reagents for AMR research.
- On-going AMR work has been put on hold or stopped.
- Some international AMR research has been cut or suspended.

Social distancing requirements limited lab capacity systematically reducing scientific output.

Lockdown and new restrictions led to suspended fieldwork with a dramatic reduction in environmental sampling.



National Wastewater Epidemiological Surveillance Programme

PI:

Andrew Singer (UK Centre for Ecology & Hydrology)

Lead CoIs:

Davey Jones (*University of Bangor*)

Kata Farkas (*University of Bangor*)

Barbara Kasprzyk-Hordern (*Bath University*)

David Graham (*Newcastle University*)

Marcos Quintela-Baluja (*Newcastle University*)

Alex Corbishley (*University of Edinburgh*)

Rowland Kao (*University of Edinburgh*)

David Allen (*London School of Hygiene & Tropical Medicine*)

Terry Burke (*University of Sheffield*)

Koen Pouwels (*University of Oxford*)

Chris Jewell (*University of Lancaster*)

Behavioural Change: PPE

Positive: Widespread use of alcohol-based hand sanitizers will have reduced infections.

Positive: Rigorous PPE use in community & hospitals might have impacted our “culture” with long-term implications for AMR.

Negative: Continued sale of non-alcoholic hand sanitizers containing biocides will maintain/increase some AMR.



| | ORIGINAL | MOISTURE | TOTAL | SENSITIVE |
|-----------------------|--------------|--------------|-------|------------|
| Sizes available | 100ml, 250ml | 100ml, 250ml | 100ml | 100ml |
| Kills bacteria | ✓ | ✓ | ✓ | ✓ |
| Alcohol Content (v/v) | 57.6% | 66% | 66% | No alcohol |

CDC recommends at least 60% ethyl alcohol (ethanol) or 70% isopropyl alcohol (isopropanol)

Poly(hexamethylenetriamine) hydrochloride 0.1%,
Didecyldimethylammonium chloride 0.15%. (QAC)

Summary: AMR Hazard from COVID-19

The early increase in antibiotic prescribing by the NHS during COVID-19 pandemic has unlikely lead to increased environmental AMR.

Lasting impact on AMR could come from reduced AMR research, diverted funds, changing agendas.

Culture change from embedding PPE might be a positive legacy with huge implications on AMR.

