Characterising clostridiodes difficile infections in the Southwest of England with the BNSSG systemwide dataset

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INTRODUCTION

Bacterial infections present many problems for patients and clinicians ranging from unpleasant to life-threatening. In partnership with Bristol, North Somerset, South Gloucestershire (BNSSG) Integrated Care Board (ICB), we have obtained a large regional dataset to describe the characteristics **for clostridioides difficile infections (CDIs)** in BNSSG and develop prediction models for risk assessment and to support optimal antibiotic prescribing and stewardship. These infections are locally problematic, may involve strains resistant to antimicrobial treatment, and in some cases lead to sepsis which can be fatal. This comprehensive dataset contains routinely collected health data covering nearly 1M patients in the ICB area across sources from primary and secondary care and pathology laboratories.

AIMS

Curate and transform disparate data sources into a coherent patient level description of daily medical history over a 3-year period

Describe general characteristics of the CDI, and control populations

Use logistic regression models to estimate risk factors for CDI infections to inform local clinicians

Develop predictive time-series models focused on these risk factors and antimicrobial stewardship

MATERIAL & METHODS

The BNSSG systemwide data set includes adult patient data regarding:

Primary care data: Demographics, living status, comorbidities

Primary care Prescription Dispensations: Antibiotics, immunosuppressants, catheters, gastrointestinal and nutrition, hormones.

Secondary care data: ICD-10 diagnosis and OPCS procedure codes, related to infections, chemotherapy, and gastrointestinal and urinary health.

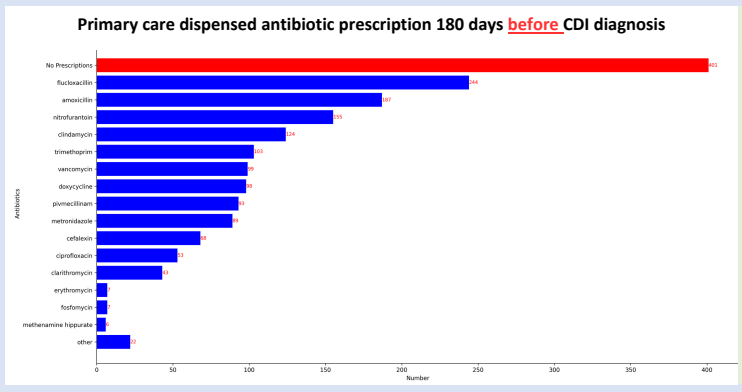
Pathology data: Urinary and blood bacterial culture results, antimicrobial resistance tests, stool tests for C. Difficile infection, and virology test results.

Data are linked at the patient level and aligned to create timeline of medical events over the three-year data capture period.

RESULTS

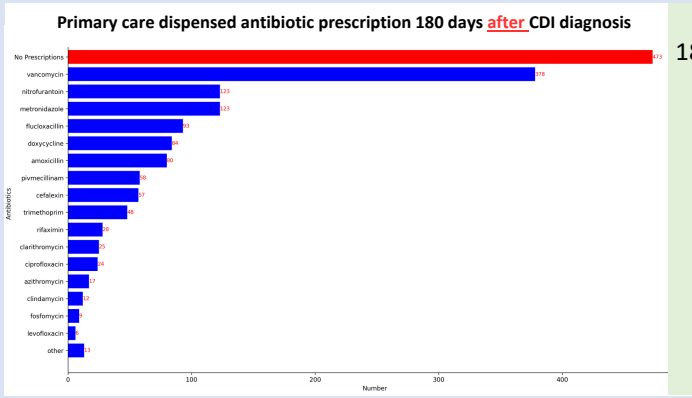
The dataset spans Oct 2019 to Jul 2022 and has records for 962,000 patients.

23,900 stool specimens were processed for CDI tests in both primary and secondary care. 1088 patients had at least one positive CDI case (combination of positive GDH/PCR + Toxin).



180 days **before** the detection of CDI:

- About 400 patients with positive CDI tests have no antibiotic prescriptions
- Most patients have Flucloxacillin dispensations, followed by Amoxicillin and Nitrofurantoin

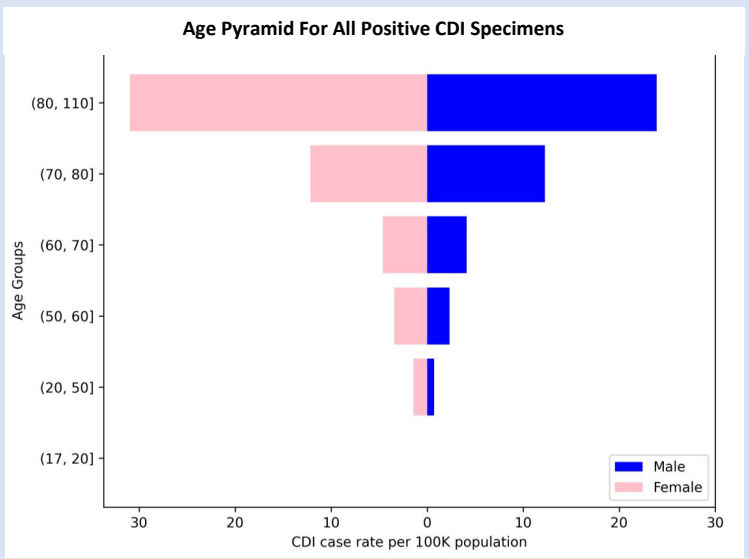


180 days **after** the detection of CDI:

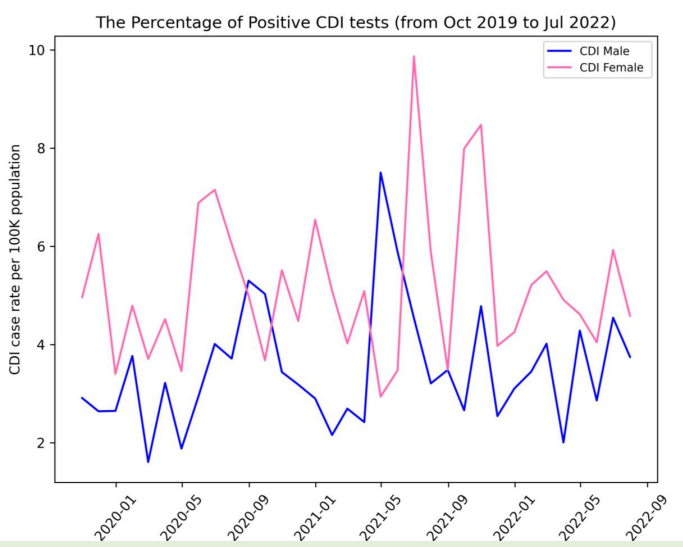
- 470+ patients with positive CDI tests have no antibiotic prescriptions
- Vancomycin is the commonest (first blue line) CDI treatment
- 370+ patients have Vancomycin dispensations after their diagnosis.

GDH	TOXIN	PCR	CDI?	Primary	Secondary	Sum	TOTAL
NEG	NEG	NEG	NO	0	0	0	
NEG	.	NEG	NO	77	88	165	
NEG	NEG	.	NO	1	0	1	
NEG	.	.	NO	8194	13192	21386	
.	NEG	NEG	NO	1	0	1	22858 (NEG)
.	NEG	.	NO	0	0	0	
POS	.	NEG	NO	316	531	847	
POS	NEG	.	NO	0	0	0	
POS	NEG	NEG	NO	87	371	458	
				8676	14182		
POS	POS	NEG	YES	94	286	380	
POS	.	POS	YES	254	445	699	1088
POS	POS	.	YES	1	0	1	(POS)
POS	POS	POS	YES	1	7	8	
				350	738		
POS	NEG	POS	.	1	0	1	
POS	.	.	.	3	6	9	
.	POS	.	.	0	2	1	
NEG	.	POS	.	2	0	1	
NEG	POS	.	.	0	0	0	
						23958	

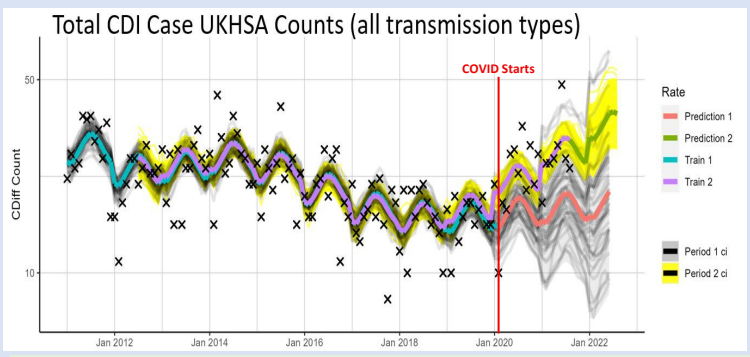
CDI is typically diagnosed using a GDH/PCR test followed by a Toxin test. Most tests have negative results.

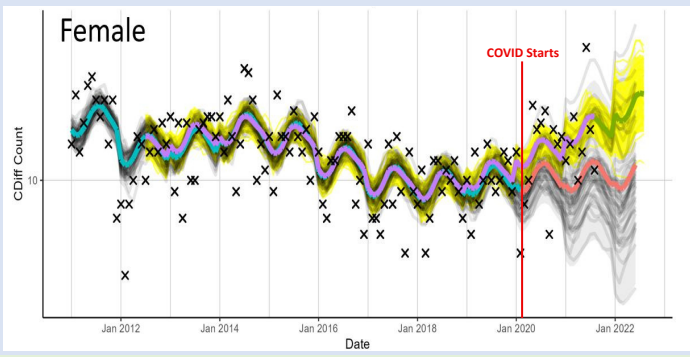


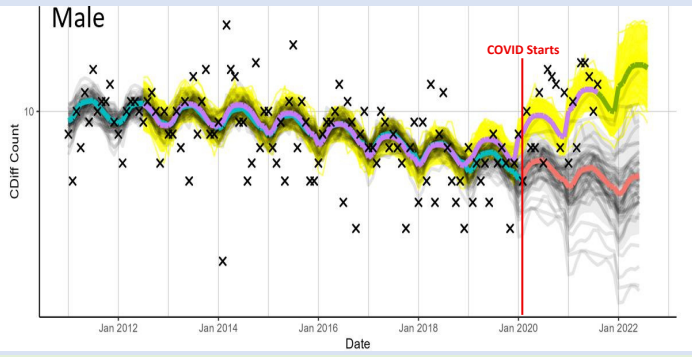
CDI Infection case rates tend to be more frequent in women and older patients



Counts of positive tests have seen a small increase but data is noisy and is suited to a Bayesian model







Bayesian Model Example on UKHSA BNSSG Data

We model CDI counts as a Poisson regression with smoothing splines for seasonality and overall trend. Once the model is fitted, we can sample many times to generate grey uncertainty estimates comparing two possible models, one using data during the COVID-19 pandemic and one without.

SUMMARY

The BNSSG systemwide dataset offers an unprecedented view of linked patient level data at the ICB level over three years with day-to-day descriptions of medical events crucial to understanding bacterial infection, antimicrobial prescribing and resistance. We present a variety of visualisations and analyses of this comprehensive dataset. The project is a work in progress and given the scope of the dataset has many possible avenues for analysis and visualization. We are currently in the descriptive phase of analysis but are preparing to create risk factor models.

ACKNOWLEDGEMENTS

This work was supported by Health Data Research UK via the Better Care Partnership Southwest (HDR CF0129) awarded to Dr Dowsey and the University of Bristol Policy Support Fund awarded to Dr Sullivan. The data used in this paper are from the Bristol, North Somerset and South Gloucestershire (BNSSG) System Wide Dataset and cannot be shared openly. The system-wide dataset is a pseudonymised dataset drawing from primary care, secondary care, community services and mental health electronic health records. The BNSSG Integrated Care Board is the data controller of this data. Access is restricted to staff working within the Integrated Care Board's Transformation and Digital team and their approved processors. As this resource supports the BNSSG population's health, rather than being an open research resource, those seeking access will need to demonstrate a primary value to the BNSSG population. Please see https://bnssg.icb.nhs.uk/health-and-care/population-health-management/ for more information.