Genotype–phenotype correlation of β-lactamase-producing uropathogenic Escherichia coli (UPEC) strains from Bangladesh

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Biological question being investigated

Background:

- **E. coli** as a common pathogen in clinical settings.

- **UPEC strains** cause urinary tract infections (UTIs).

- **UTIs** are among the most prevalent infections worldwide.

Biological question investigated:

- How do 11 UPEC strains from Dhaka and Sylhet, Bangladesh compare to each other and to other

  available UPEC strains at a genomic level?

Workflow carried out by the group

- Comparative genomic analysis of UPEC strains

- Investigation of sequence types, antibiotic resistance genes, and virulence factors

Overview of the group's documentation

- **Comparative Genomic Analysis**: Comparative study of 11 UPEC strains from Dhaka and Sylhet, Bangladesh, examining their genomic characteristics against each other and existing UPEC strains.

- **Diversity in Sequence Types**: MLST confirmed the strains belong to ST59, ST131, ST219, ST361, ST410, ST448, and ST4204, including a novel sequence type.

- **Antibiotic Resistance and Virulence**: Identification of antibiotic resistance genes blaNDM-5, blaNDM-7, blaCTX-M-15, and blaOXA-1, with significant virulence heterogeneity observed within UPEC phylogroups.

- **Reproduced and compared**: Table 3 and heat maps.

Results comparison

Table 3. De novo prediction of phylogroups, MLST types and serotypes of the sequenced UPEC isolates

Strain	Accession Number	Hospital	Phylogroups	MLST type	Serotype
NGE3	QEXN00000000	DCIMCH	F (D)*	ST-59	O1:H7
NGE4	QFAZ00000000	DCIMCH	A	ST-4204	O6:H10
NGE5	RCIF00000000	DCIMCH	B1	ST-10987 (Ounknown ST)	O59:H20
NGE6	RCIE00000000	DCIMCH	E (B2)	ST-219	O138:H48
NGE7	QFRN00000000	DCIMCH	B2	ST-131	O46:H4 (O25:H4)
NGE9	QFRT00000000	DCIMCH	EC control fail (B2)	ST-219	O138:H48
NGE16	QFTM00000000	ISH	B2	NA (ST-131)	O25:H4
NGE22	QFXA00000000	ISH	A	ST-4204	O6:H10
NGCE33	RBWA00000000	DCIMCH	C (A)	ST-410	O8:H9
NGCE94	RAZR00000000	DCIMCH	B1 (A)	ST-448 (ST-361)	O188:H19 (O9:H30)
NGCE100	RAZQ00000000	DCIMCH	A (B1)	ST-361 (ST-448)	H30:O9 (Ounknown:H7)

*Parentheses indicate originally published values that do not match with the reproduced values

Antibiogram results of 46 strains from Dhaka hospital
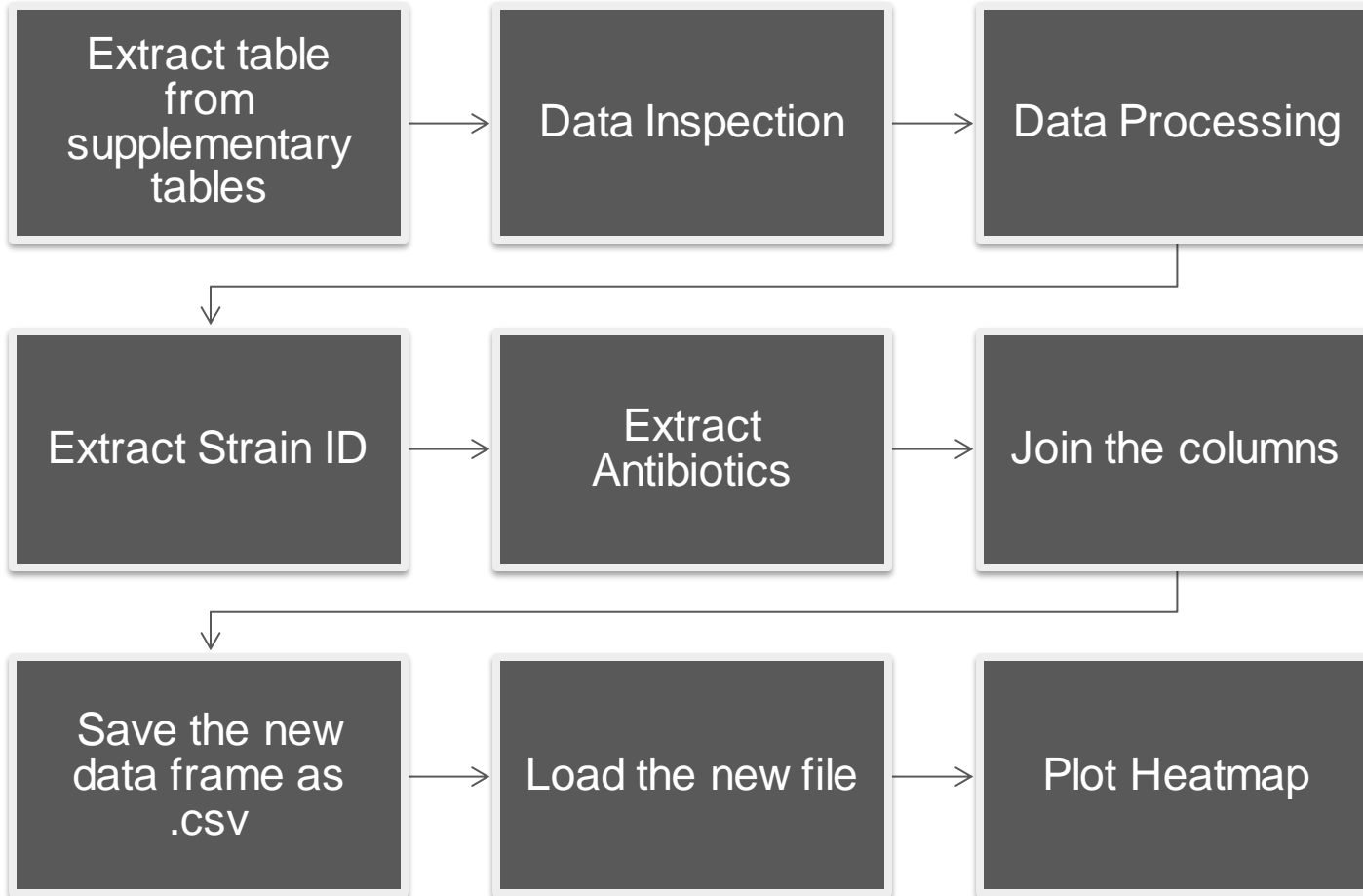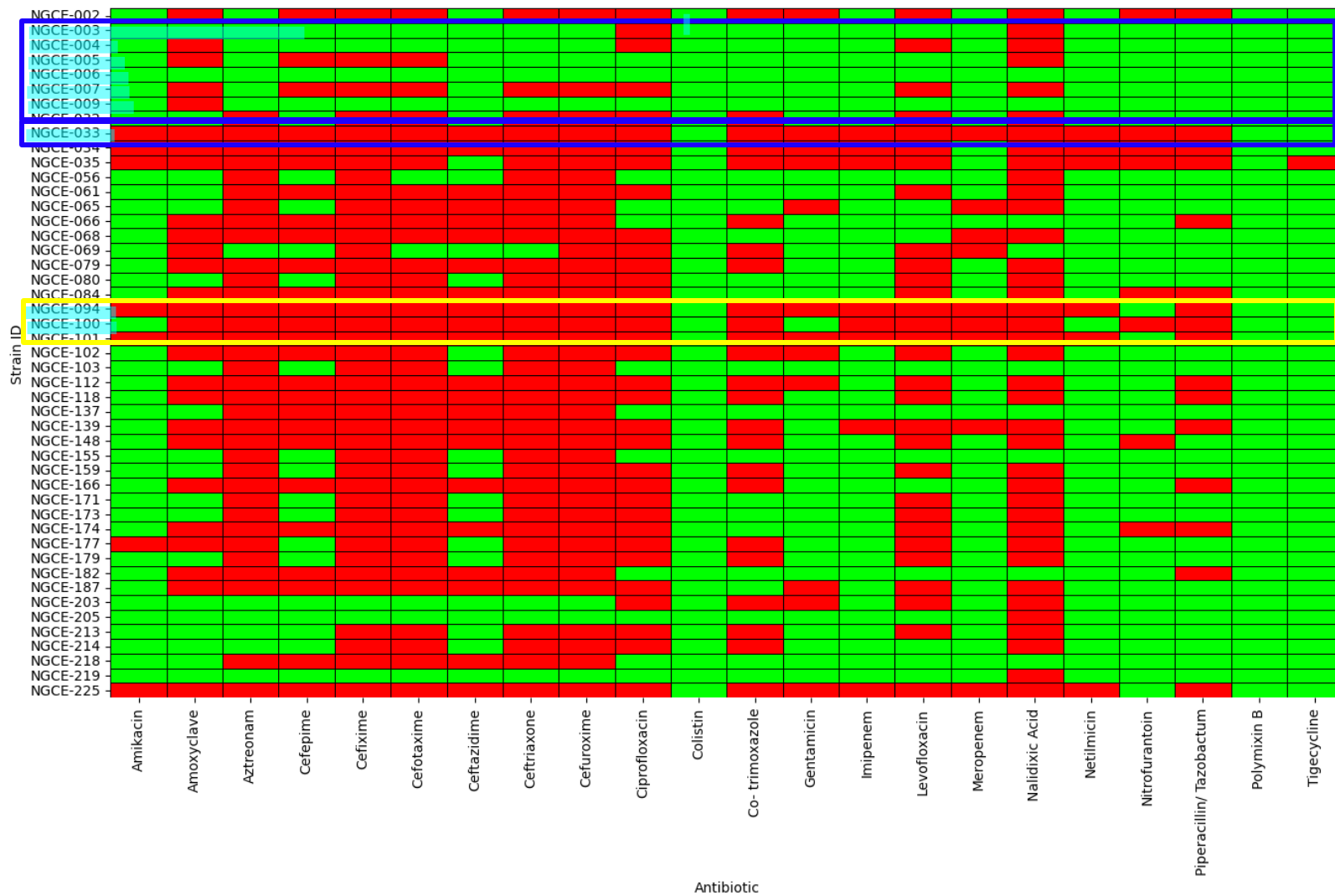
Snapshot of the data frame

Python packages
used:
- pandas
- seaborn
- Matplotlib

DHAKA HOSPITAL ID	STRAIN ID	GENDER	AGE	SAMPLE TYPE	ESBL	Amikacin	Amoxyclave	Aztreonam
77827	NGCE-002	MALE	28	URINE	-	S	R	S
78463	NGCE-003	FEMALE	39	URINE	-	S	S	S
78773	NGCE-004	MALE	64	URINE	-	S	R	S
77937	NGCE-005	FEMALE	18	URINE	-	S	R	S
79078	NGCE-006	MALE	24	URINE	-	S	S	S
78156	NGCE-007	FEMALE	71	URINE	-	S	R	S
80245	NGCE-009	MALE	35	URINE	-	S	R	S

Data Processing

Heat map for the 46 strains from Dhaka Hospital

Antibiotic Resistance and Virulence