Appendix 1. Incidence Algorithms

These algorithms were produced by the Defense Health Agency's EpiData Center (EDC), which provided the incidence data for this study.

Notes

- Data Sources:
    - Primary for determining ESKAPEE and DTR cases. Composite Health Care System (CHCS) Microbiology data collected between 2017-2022.
        - This data is delivered to the EDC via a direct daily feed from the Military Health System (MHS) Data Repository (MDR). The data are cleaned daily and processed through the BacLink and WHONET software to change the format from a long form (1 row per observation) to a wide form (to ensure susceptibility testing is on the same row as the microbiology result) with antibiotic resistance testing interpretations. Daily files are compiled into weekly, monthly, and annual files. EDC used the annual files of all records to pull positive cultures among the below pathogen groups. Formatted data to convert antibiotic abbreviations to full names. A 14-day gap in care rule was applied.
    - Case Definitions and Rules are determined from interpreting the appropriate NHSN upload and case rules.
    - Denominators for rates were pulled from the MHS Management Analysis and Reporting Tool (M2) to retrieve the number of enrolled beneficiaries by facility and year.
    - CDI Data used both CHCS Chemistry and CHCS Microbiology due to records and test types for CDI can occur in both datasets.
    - A DTR was defined using the definitions provided by the researcher, which are also outlined below.
    - The analysis and manipulation were done in SAS 9.4.

CDI Algorithm

- 2017-2018 data was generated from CHCS data sources to supplement National Healthcare Safety Network (NHSN) data
- Data pulled from Microbiology and Chemistry sources. Most of the cases are from the chemistry data. Lab cases are then cleaned and matched to inpatient data to align with NHSN requirements regarding an inpatient stay.
    - Lab Case Determination
        - Only Feces and Stool specimen sources are retained.
        - The type of test is classified from the Current Procedural Terminology (CPT) codes to determine if it was a culture, toxin or unknown test type.
            - Culture: '87040','87070', '87086', '87075', '87081', '87177', '87045', '87046', '87118', '87186','87070'
            - Toxin: '87230', '87324', '87493', '87803', '87450', '87798', '87797', '87507', '87328', '87899', '87252', '87633', '87449', '87150', '87801'
        - Classifies tests as toxin neg, toxin pos, culture neg or culture pos.

        - Breaks out unique samples to prepare for output
        - Removes results not related to CDI diagnosis
        - Keeps only tests with a positive CDI result
    - Cleaning code
        - A short code that removes test records with fake SSNs, clinical comments indicating a test record, and records indicating a QA/QC result.
    - Lab case match to Standard Inpatient Data Record (SIDR)
        - Lab cases are matched to an inpatient dataset called CHCS SIDR to determine if the case is related to an inpatient encounter, per NHSN rules.
            - Cases and Inpatient stays from NICU, SCN, baby-based clinics, inpatient rehab or inpatient psych clinics are not included.
        - Code will evaluate historical CDI cases to determine 14-day gap in care to remove duplicates
        - Cases are matched to SIDR based on Family Member Prefix (FMP) + Sponsor SSN or Patient SSN+DOB, or Sponsor SSN + Patient SSN and the collection date falls between the admit and discharge date

ESKAPEE Algorithm (Includes ESBL *E. coli* Algorithm)

- WHONET CHCS data to determine case list. 14-day gap in care rule was applied across the board.
- MSSA = S or I to OXACILLIN, METHICILLIN, or CEFOXITIN
- MRSA = R to OXACILLIN, METHICILLIN, or CEFOXITIN
- VISA = I to VANCOMYCIN
- VRSA = R to VANCOMYCIN
- VRE = R to VANCOMYCIN and Org = ENT, EFA or EFM
- ESBL= R to AZITREONAM, CEFTAZIDIME, CEFIXIME, CEFTRIAXONE, CEFOTAXIME or CEFEPIME
- CR = R to DORIPENEM, ERTAPENEM, IMIPENEM or MEROPENEM
- MDR Acinetobacter spp. and Pseudomonas aeruginosa
    - Non-susceptible (resistant or intermediate) to at least 1 agent from at least 3 of the following categories:
        - aminoglycosides - amikacin (AMK), gentamicin (GEN), tobramycin (TOB), antipseudomonal carbapenems - doripenem (DOR), imipenem (IPM), meropenem (MEM), antipseudomonal fluoroquinolones - ciprofloxacin (CIP), levofloxacin (LVX), antipseudomonal cephalosporins - ceftazidime (CAZ), cefepime (FEP), antipseudomonal penicillins+inhibitors - piperacillin (PIP), piperacillin/tazobactam (TZP)
        - acinetobacter spp. only penicillins+inhibitors - ampicillin/sulbactam (SAM)
- MDR streptococcus pneumoniae isolates must be resistant to penicillin and at least two other non-beta-lactamase antibiotics

DTR Algorithm

Pathogen Groups:

Enterobacterales: if organism code = 'ENTEROBACTER AEROGENES', 'KLEBSIELLA AEROGENES', 'ENTEROBACTER CLOACAE', 'ENTEROBACTER GERGOVIAE', 'ENTEROBACTER NONAEROGENES', 'ENTEROBACTER NON CLOACAE', 'ENTEROBACTER SP.', 'ENTEROBACTER SPECIES', 'ESCHERICHIA COLI', 'ESCHERICHIA HERMANII', 'HAFNIA ALVEI', 'HAFNIA SP.', 'KLEBSIELLA OXYTOCA', 'KLEBSIELLA PNEUMONIAE', 'LECLERCIA ADECARBOXYLATA', 'PROTEUS MIRABILIS', 'RAOULTELLA ORNITHOLYTICA', 'SERRATIA FONTICOLA', 'SERRATIA MARCESCENS', 'SERRATIA ODORIFERA', 'SERRATIA ODORIFERA 1', 'SERRATIA PLYMUTHICA', or 'SHIGELLA SONNEI'

OR organism code contains ‘CITROBACTER’, ‘ENTEROBACTER’, ‘ESCHERICHIA COLI’, ‘MORGANELLA’, ‘PANTOEA’, ‘PROTEUS’, ‘PROVIDENCIA’, ‘SERRATIA’, ‘SALMONELLA’, OR ‘ YERSINIA

Pseudomonas aeruginosa: if organism code = ‘PSEUDOMONAS AERUGINOSA’

Acinetobacter baumanni: if organism code = ‘ACINETOBACTER BAUMANNII', 'ACINETOBACTER BAUMANNII CALCOACETICUS COMPLEX', 'ACINETOBACTER BAUMANNII COMPLEX' , or 'ACINETOBACTER CALCOACETICUS-BAUMANNII COMPLEX'

Enterobacterales DTR if:

Resistance or Intermediate to: Imipenem, meropenem, doripenem, ertapenem, ceftazidime, cefepime, ceftriaxone, cefotaxime, ciprofloxacin, levofloxacin, moxifloxacin, piperacillin-tazobactam, aztreonam, ampicillin, ampicillin-sulbactam, amoxicillin-clavulanate, or cefazolin.

Pseudomonas DTR if:

Resistance or Intermediate to: Imipenem, meropenem, doripenem, ceftazidime, cefepime, ciprofloxacin, levofloxacin, piperacillin-tazobactam, or aztreonam.

Acinetobacter DTR if:

Resistance or Intermediate to: Imipenem, meropenem, doripenem, ceftazidime, cefepime, ciprofloxacin, levofloxacin, moxifloxacin, piperacillin-tazobactam, or ampicillin-sulbactam.

Pathogen Groups	Inclusion of Specific Pathogens	Agent Category	Specific Agents Included
Enterobacterales (for this study, specifically: Escherichia coli, Enterobacter spp., Klebsiella spp.)	Inclusive of: Citrobacter spp., Enterobacter aerogenes (now Klebsiella aerogenes), Enterobacter cloacae, Enterobacter gergoviae, Enterobacter non-aerogenes, non-cloacae spp., Enterobacter spp., Escherichia coli, Escherichia hermannii, Hafnei spp., Klebsiella oxytoca, Klebsiella pneumoniae, Leclercia adecarboxylata, Morganella spp., Pantoea spp., Proteus mirabilis, Proteus spp. (non-mirabilis), Providencia spp., Raoultella ornithinolytica, Serratia fonticola, Serratia marcescens, Serratia odaifera, Serratia plymutica, Serratia spp., Shigella sonnei, Salmonella ssp. and Yersinia ssp.	Carbapenem	Imipenem, meropenem, doripenem, ertapenem
		Extended-spectrum cephalosporin-resistant	Ceftazidime, cefepime, ceftriaxone, cefotaxime
		Fluoroquinolone	Ciprofloxacin, levofloxacin, moxifloxacin
		Other	Piperacillin-tazobactam
		Other	Aztreonam
			Ampicillin, ampicillin-sulbactam (or amoxicillin-clavulanate if that is what is reported), cefazolin
Pseudomonas aeruginosa		Carbapenem	Imipenem, meropenem, doripenem
		Extended-spectrum cephalosporin-resistant	Ceftazidime, cefepime
		Fluoroquinolone	Ciprofloxacin, levofloxacin
		Other	Piperacillin-tazobactam
		Other	Aztreonam
Acinetobacter baumanni		Carbapenem	Imipenem, meropenem, doripenem
		Extended-spectrum cephalosporin-resistant	Ceftazidime, cefepime
		Fluoroquinolone	Ciprofloxacin, levofloxacin, moxifloxacin
		Other	Piperacillin-tazobactam
		Other	Ampicillin-sulbactam