**Table S1.** Characteristics of Johns Hopkins Health System Emergency Departments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Characteristics\* | JHH ED | JHBMC ED | HCGH ED | SH ED | SMH ED |
|  | Adjusted OR (95% CI) |
| Location | Baltimore, MD | Baltimore, MD | Columbia, MD | Bethesda, MD | Washington, DC |
|  |  |  |  |  |  |
| Community Setting | Urban | Urban | Suburban | Suburban | Suburban/ Urban |
|  |  |  |  |  |  |
| Hospital Type | Academic | Academic | Community | Community | Community |
|  |  |  |  |  |  |
| Male Patients – % | 48.6 | 43.9 | 43.0 | 40.1 | 40.7 |
|  |  |  |  |  |  |
| Age of Patients in Years – Median (IQR) | 55 (37–67) | 62 (46–75) | 69 (52–81) | 76 (62-86) | 72 (52-98) |
|  |  |  |  |  |  |
| Race/Ethnicity of Patients – %  |  |  |  |  |  |
| White | 36.6 | 64.4 | 55.6 | 64.7 | 59.2 |
| Black | 52.6 | 26.2 | 26.8 | 16.0 | 28.5 |
| Asian | 2.5 | 0.9 | 8.4 | 6.3 | 2.8 |
| Hispanic | 5.3 | 6.4 | 6.2 | 8.1 | 5.4 |
| Other | 3.1 | 2.1 | 3.0 | 4.8 | 4.2 |
|  |  |  |  |  |  |
| ED Visits – No. |  |  |  |  |  |
| 2017 | 66421 | 51641 | 59582 | 41037 | 38715 |
| 2018 | 64490 | 50582 | 61531 | 41101 | 40849 |
| 2019 | 65893 | 47591 | 60040 | 41324 | 42801 |
| 2020 | 54221 | 41749 | 47055 | 33800 | 31848 |
| 2021 | 58064 | 43471 | 51495 | 39852 | 35611 |
|  |  |  |  |  |  |
| Bacterial Cultures Obtained in the ED – No. |  |  |  |  |  |
| 2017 | 11478 | 7548 | 11895 | 12286 | 9006 |
| 2018 | 11028 | 7656 | 11728 | 15354 | 9716 |
| 2019 | 11027 | 8372 | 12728 | 15643 | 10356 |
| 2020 | 9142 | 7781 | 11002 | 13719 | 9242 |
| 2021 | 10504 | 7975 | 11946 | 13089 | 8933 |
|  |  |  |  |  |  |
| ESBL-E Positive Cultures Obtained in the ED† – No. |  |  |  |  |  |
| 2019 | 106 | 99 | 159 | 228 | 122 |
| 2020 | 134 | 98 | 107 | 156 | 110 |
| 2021 | 124 | 107 | 146 | 182 | 92 |

Abbreviations: ED = Emergency Department; ESBL-E = Extended-spectrum β-lactamase producing Enterobacterales; HCGH = Howard County General Hospital; IQR = Interquartile range; JHBMC = Johns Hopkins Bayview Medical Center; JHH = Johns Hopkins Hospital; SMH = Sibley Memorial Hospital; SH = Suburban Hospital

\*Patient characteristics reported for patients seen at each site from 2017 to 2021

†ESBL status of cultures was not assessed prior to 2019 due to differences in how the Johns Hopkins Health System microbiology laboratories assessed ESBL-E status prior to 2019

**Table S2.** Description of Data Collected for Variables

|  |  |
| --- | --- |
| Variable | Description of Data Used for Variable |
| Age | Patient age in years at time of the presentation as documented in the EHR |
|  |  |
| Sex | Patient sex as documented in the EHR |
|  |  |
| Race and Ethnicity | Patient self-reported race and ethnicity as documented in the EHR |
|  |  |
| Comorbidity Variables | ICD-10 codes for the condition on the patient’s EHR problem list at any time prior to presentation, except for a cancer comorbidity; ICD-10 codes for cancer were only evaluated in the 6 months prior to presentation |
|  |  |
| Antibiotic Use Variables | Documented administration of at least one dose of the antibiotic in the EHR within six months prior to presentation (does not include antibiotics that were prescribed but not documented as being administered in the EHR) |
|  |  |
| Gastric Acid Suppressant Use | Documented administration of at least one dose of the acid suppressant medication in the EHR within six months prior to presentation (does not include medications that were prescribed but not documented as being administered in the EHR) |
|  |  |
| Device or Hardware at Presentation | Device or hardware documented in the EHR with a date of insertion prior to the time of presentation and date of removal after time of presentation |
|  |  |
| Hospitalization | Hospitalization encounter in JHHS in the EHR within the six months prior to presentation |
|  |  |
| ICU Admission | ICU encounter in JHHS in the EHR within the six months prior to presentation |
|  |  |
| Surgery or Procedure | Surgery or procedure encounter in JHHS in the EHR within the six months prior to presentation |
|  |  |
| Long Term Care Facility or Skilled Nursing Facility Admission | Arrival source in the EHR at of presentation indicating arrival from long term care facility or skilled nursing facility, or documented discharge from a hospital encounter in JHHS to a long term care facility or skilled nursing facility in the six months prior to presentation |
|  |  |
| Microbiology Related Variables | Specimen source, organism name, ESBL status as determined by the microbiology laboratory, and susceptibilities as documented in the EHR for cultures in JHHS obtained within the year prior to presentation (only *Escherichia coli, Klebsiella pneumoniae, Klebsiella. oxytoca, or Proteus mirabilis* isolates were evaluated for ESBL status) |

Abbreviations: EHR = Electronic health record; ESBL = Extended-spectrum β-lactamase; ICD-10 = International Classification of Diseases, Tenth Revision; ICU = Intensive care unit; JHHS = Johns Hopkins Health System

**Table S3.** Univariable Logistic Regression Models Evaluating Risk Factors for Isolation of an Extended-Spectrum β-Lactamase Producing Enterobacterales from Emergency Department Patients

|  |  |
| --- | --- |
| Baseline Characteristics | Unadjusted Odds Ratio (95% CI) |
| Age group |  |
| 18-25 yr | Ref |
| 26-35 yr | 2.18 (1.41-3.38) |
| 36-45 yr | 1.90 (1.21-2.99) |
| 46-55 yr | 2.78 (1.81-4.25) |
| 56-65 yr | 3.18 (2.11-4.77) |
| 66-75 yr | 3.33 (2.23-4.97) |
| 76-85 yr | 2.81 (1.88-4.19) |
| >85 yr | 1.97 (1.30-2.98) |
|  |  |
| Male Sex | 1.60 (1.41-1.82) |
|  |  |
| Race/Ethnicity |  |
| White | Ref |
| Black | 1.21 (1.05-1.39) |
| Asian | 1.60 (1.24-2.06) |
| Hispanic | 1.58 (1.29-1.94) |
| Other | 2.08 (1.58-2.74) |
|  |  |
| Comorbidities |  |
| Diabetes | 1.68 (1.45-1.95) |
| Chronic Kidney Disease | 1.75 (1.48-2.10) |
| Chronic Pulmonary Disease | 1.46 (1.20-1.77) |
| Chronic Liver Disease | 1.19 (0.86-1.65) |
| Cancer | 0.98 (0.80-1.18) |
| HIV Positive | 1.39 (0.83-2.33) |
|  |  |
| Antibiotic Use (<6 Months) |  |
| 3rd Generation Cephalosporin | 3.12 (2.70-3.61) |
| 4th Generation Cephalosporin | 2.73 (2.24-3.34) |
| Piperacillin-Tazobactam | 2.28 (1.85-2.81) |
| Carbapenem | 8.41 (6.77-10.44) |
| Fluoroquinolone | 2.43 (1.89-3.12) |
| Aminoglycoside | 2.28 (1.43-3.62) |
| Trimethoprim-Sulfamethoxazole | 2.98 (2.21-4.01) |
| Aztreonam | 2.67 (1.39-5.12) |
| Metronidazole | 1.87 (1.46-2.39) |
| Other | 1.90 (1.65-2.19) |
|  |  |
| Acid Suppressant Use (<6 Months) |  |
| Proton Pump Inhibitor | 2.15 (1.84-2.51) |
| H2 Antagonist | 1.91 (1.56-2.34) |
|  |  |
| Device or Hardware at Presentation |  |
| Urinary Catheter | 2.32 (1.75-3.06) |
| Tracheostomy | 8.13 (3.92-16.90) |
| Gastrointestinal Feeding Tube | 2.44 (1.16-5.12) |
| Central Line | 1.64 (1.12-2.41) |
|  |  |
| Healthcare Exposure (<6 months) |  |
| Hospitalization | 2.14 (1.87-2.46) |
| ICU Admission | 2.96 (2.30-3.79) |
| Surgery or Procedure | 1.62 (1.41-1.87) |
| Long Term Care Facility or Skilled Nursing Facility Admission | 2.19 (1.89-2.53) |
|  |  |
| History of ESBL-E (<6 months) | 42.68 (29.53-61.69) |
|  |  |
| Prevalence of ESBL-E within Patient’s CBG Community (<3 months) |  |
| <25th Percentile | 0.84 (0.72-0.98) |
| 25th to 75th Percentile | Ref |
| >75th Percentile | 0.93 (0.80-1.08) |
|  |  |
| Prevalence of ESBL-E within Patient’s CBG Community (<6 months) |  |
| <25th Percentile | 0.86 (0.74-1.00) |
| 25th to 75th Percentile | Ref |
| >75th Percentile | 0.92 (0.79-1.06) |
|  |  |
| Prevalence of ESBL-E within Patient’s CBG Community (<12 months) |  |
| <25th Percentile | 0.84 (0.72-0.98) |
| 25th to 75th Percentile | Ref |
| >75th Percentile | 0.99 (0.85-1.14) |

Abbreviations: ESBL-E = Extended-spectrum β-lactamase producing Enterobacterales; CBG = Census block group; ICU = Intensive care unit; H-2 = Histamine H2-receptor; HIV = Human Immunodeficiency Virus

**Table S4.** Multivariable Logistic Regression Models Evaluating Risk Factors for Isolation of an Extended-Spectrum β-Lactamase (ESBL) Producing Enterobacterales from Emergency Department Patients without an ESBL Positive Culture in the Past Year

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Baseline Characteristics | Model 1\* | Model 2† | Model 3ǂ | Model 4¶ |
|  | Adjusted OR (95% CI) |
| Age group |  |  |  |  |
| 18-25 yr | Ref | Ref | Ref | Ref |
| 26-35 yr | 2.12 (1.33-3.38) | 2.12 (1.33-3.39) | 2.13 (1.33-3.39) | 2.12 (1.33-3.38) |
| 36-45 yr | 1.72 (1.06-2.79) | 1.73 (1.07-2.80) | 1.73 (1.07-2.80) | 1.72 (1.06-2.79) |
| 46-55 yr | 2.47 (1.56-3.91) | 2.48 (1.56-3.92) | 2.47 (1.56-3.92) | 2.46 (1.55-3.89) |
| 56-65 yr | 3.00 (1.93-4.66) | 3.00 (1.93-4.66) | 3.00 (1.93-4.67) | 2.99 (1.92-4.66) |
| 66-75 yr | 3.06 (1.97-4.73) | 3.08 (1.99-4.76) | 3.07 (1.98-4.76) | 3.06 (1.98-4.74) |
| 76-85 yr | 2.58 (1.66-4.00) | 2.59 (1.67-4.01) | 2.59 (1.67-4.01) | 2.58 (1.66-4.00) |
| >85 yr | 1.81 (1.15-2.86) | 1.82 (1.15-2.87) | 1.82 (1.15-2.86) | 1.80 (1.14-2.84) |
|  |  |  |  |  |
| Male Sex | 1.29 (1.11-1.49) | 1.29 (1.12-1.49) | 1.29 (1.12-1.49) | 1.29 (1.11-1.48) |
|  |  |  |  |  |
| Race/Ethnicity |  |  |  |  |
| White | Ref | Ref | Ref | Ref |
| Black | 1.23 (1.05-1.45) | 1.23 (1.04-1.44) | 1.22 (1.04-1.44) | 1.22 (1.04-1.44) |
| Asian | 1.86 (1.41-2.46) | 1.85 (1.40-2.44) | 1.86 (1.41-2.45) | 1.85 (1.40-2.43) |
| Hispanic | 2.26 (1.80-2.85) | 2.27 (1.80-2.86) | 2.27 (1.80-2.85) | 2.25 (1.79-2.83) |
| Other | 2.68 (1.99-3.61) | 2.66 (1.97-3.58) | 2.66 (1.98-3.59) | 2.66 (1.97-3.58) |
|  |  |  |  |  |
| Comorbidities |  |  |  |  |
| Diabetes | 1.14 (0.95-1.37) | 1.15 (0.95-1.38) | 1.15 (0.95-1.38) | 1.14 (0.95-1.37) |
| Chronic Kidney Disease | 1.27 (1.03-1.58) | 1.27 (1.03-1.58) | 1.27 (1.02-1.57) | 1.28 (1.03-1.58) |
| Chronic Pulmonary Disease | 1.18 (0.94-1.48) | 1.18 (0.94-1.49) | 1.18 (0.94-1.49) | 1.19 (0.95-1.50) |
| Chronic Liver Disease | 0.76 (0.52-1.11) | 0.76 (0.52-1.11) | 0.76 (0.52-1.11) | 0.76 (0.52-1.11) |
| Cancer | 0.69 (0.55-0.88) | 0.70 (0.55-0.88) | 0.69 (0.55-0.87) | 0.69 (0.55-0.87) |
| HIV Positive | 1.08 (0.61-1.92) | 1.09 (0.62-1.95) | 1.09 (0.62-1.95) | 1.09 (0.62-1.95) |
|  |  |  |  |  |
| Antibiotic Use (<6 Months) |  |  |  |  |
| 3rd Generation Cephalosporin | 1.77 (1.43-2.19) | 1.77 (1.43-2.19) | 1.78 (1.44-2.20) | 1.78 (1.44-2.20) |
| 4th Generation Cephalosporin | 1.15 (0.85-1.54) | 1.15 (0.86-1.54) | 1.15 (0.85-1.54) | 1.16 (0.86-1.56) |
| Piperacillin-Tazobactam | 0.86 (0.64-1.15) | 0.86 (0.64-1.15) | 0.86 (0.64-1.15) | 0.85 (0.63-1.14) |
| Carbapenem | 2.83 (2.03-3.96) | 2.82 (2.01-3.94) | 2.83 (2.03-3.97) | 2.84 (2.03-3.98) |
| Fluoroquinolone | 1.23 (0.88-1.71) | 1.24 (0.89-1.72) | 1.24 (0.89-1.72) | 1.24 (0.89-1.72) |
| Aminoglycoside | 0.78 (0.39-1.56) | 0.78 (0.39-1.57) | 0.78 (0.39-1.57) | 0.78 (0.39-1.57) |
| Trimethoprim-Sulfamethoxazole | 1.73 (1.19-2.51) | 1.72 (1.18-2.51) | 1.72 (1.18-2.50) | 1.72 (1.18-2.50) |
| Aztreonam | 1.23 (0.57-2.66) | 1.21 (0.56-2.63) | 1.22 (0.56-2.64) | 1.22 (0.56-2.65) |
| Metronidazole | 0.85 (0.61-1.19) | 0.85 (0.61-1.19) | 0.85 (0.61-1.19) | 0.85 (0.61-1.20) |
| Other | 0.98 (0.80-1.20) | 0.97 (0.79-1.19) | 0.97 (0.79-1.19) | 0.97 (0.79-1.19) |
|  |  |  |  |  |
| Acid Suppressant Use (<6 Months) |  |  |  |  |
| Proton Pump Inhibitor | 0.95 (0.76-1.19) | 0.95 (0.76-1.19) | 0.95 (0.76-1.19) | 0.95 (0.75-1.19) |
| H2 Antagonist | 1.14 (0.88-1.49) | 1.15 (0.88-1.49) | 1.14 (0.87-1.48) | 1.13 (0.87-1.47) |
|  |  |  |  |  |
| Device or Hardware at Presentation |  |  |  |  |
| Urinary Catheter | 1.31 (0.94-1.83) | 1.33 (0.95-1.85) | 1.33 (0.96-1.86) | 1.31 (0.94-1.83) |
| Tracheostomy | 3.70 (1.57-8.70) | 3.64 (1.55-8.56) | 3.65 (1.55-8.60) | 3.62 (1.53-8.56) |
| Gastrointestinal Feeding Tube | 0.93 (0.37-2.33) | 0.91 (0.36-2.29) | 0.93 (0.37-2.31) | 0.93 (0.37-2.33) |
| Central Line | 0.90 (0.57-1.43) | 0.89 (0.56-1.40) | 0.88 (0.56-1.40) | 0.89 (0.56-1.40) |
|  |  |  |  |  |
| Healthcare Exposure (<6 months) |  |  |  |  |
| Hospitalization | 0.80 (0.64-1.01) | 0.80 (0.64-1.01) | 0.80 (0.64-1.01) | 0.80 (0.64-1.01) |
| ICU Admission | 1.37 (0.97-1.94) | 1.38 (0.97-1.96) | 1.38 (0.98-1.96) | 1.38 (0.97-1.96) |
| Surgery or Procedure | 1.20 (1.01-1.43) | 1.38 (1.02-1.44) | 1.21 (1.01-1.44) | 1.21 (1.01-1.43) |
| Long Term Care Facility or Skilled Nursing Facility Admission | 1.71 (1.42-2.05) | 1.71 (1.42-2.05) | 1.70 (1.42-2.05) | 1.71 (1.42-2.06) |
|  |  |  |  |  |
| Prevalence of ESBL-E within Patient’s CBG Community Aggregate |  |  |  |  |
| <25th Percentile | - | 0.82 (0.70-0.97) | 0.82 (0.72-0.98) | 0.79 (0.67-0.94) |
| 25th to 75th Percentile | - | Ref | Ref | Ref |
| >75th Percentile | - | 0.95 (0.81-1.12) | 0.93 (0.79-1.09) | 1.00 (0.85-1.17) |

Abbreviations: CBG = Census block group; ESBL-E = Extended-spectrum β-lactamase producing Enterobacterales; H-2 = Histamine H2-receptor; HIV = Human Immunodeficiency Virus; ICU = Intensive care unit; OR = Odds Ratio

\*Model 1: Includes previously identified risk factors in the literature as dichotomous variables.

†Model 2: Model 1 and a categorical variable indicating percentile for proportion of ESBL-producing isolates within the patient’s CBG community in the previous 3 months.

ǂModel 3: Model 1 and a categorical variable indicating percentile for proportion of ESBL-producing isolates within the patient’s CBG community in the previous 6 months.

¶Model 4: Model 1 and a categorical variable indicating percentile for proportion of ESBL-producing isolates within the patient’s CBG community in the previous 12 months.