System. Georgia vital records data were used to determine 90-day mortality rates. Prevalence estimates were calculated. Comparisons used a χ^2 test.

Results. Of 1,511 CRE cases, 136 (9%) were on current chronic dialysis, 128 (94%) of which were on hemodialysis (HD) and 5 (4%) were on peritoneal dialysis. Among CRE cases with HD, 94 (73%) had a catheter and 30 (23%) had an arteriovenous fistula or graft. CRE cases with ESRD were more likely to be male (58% vs. 40%), black (76% vs. 38%), and have diabetes (67% vs. 38%), congestive heart failure (25% vs. 17%), or peripheral arterial disease (12% vs. 4%). CRE cases with ESRD had more hospitalizations within 30 days of the culture date (77% vs. 47%), ICU admissions prior to (29% vs. 7%) or after the culture date (43% vs. 14%) and discharges to LTCFs (35% vs. 15%) after hospitalization. CRE cases with ESRD and bacteremia were more likely to have been hospitalized >3 days before the culture compared with CRE cases with ESRD and positive cultures from other body sites (52% vs. 24%). The 90-day mortality rate per 100,000 population was higher among CRE cases with ESRD (100.9 cases) than without ESRD (1.0 cases).

Conclusion. Among a population-based cohort of patients with CRE infections, ESRD comprised ~10% but had markedly mortality, suggesting that future interventions should target ESRD.

Disclosures. **All authors:** No reported disclosures.

505. Making of a "Super-Duper Bug": Plasmid-Mediated Resistance Accumulation in a Carbapenemase-Producing *Klebsiella quasipneumoniae* from Patients and the Environment

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Background. Carbapenemase-producing Enterobacteriaceae can form a reservoir in hospital wastewater biofilms. *Klebsiella quasipneumoniae* is increasingly recognized as an emerging nosocomial threat, frequently carrying antimicrobial resistance (AMR) genes on plasmids. The dynamics of AMR gene and plasmid gain/loss over time in this species remain unclear.

Methods. *Klebsiella pneumoniae* carbapenemase producing-*K. quasipneumoniae* (KPC-*Kq*) isolates from patients and wastewater sites from drains and toilets were sequenced (Illumina). Sequence assemblies (SPAdes) were probed in silico for AMR genes and plasmid Incompatibility types (using AMRFinder and PlasmidFinder databases, respectively). For related isolates (<100 SNV) cultured from the same sites longitudinally, we compared the accumulation of AMR genes in patients and environmental reservoirs over time.

Results. From 2009 to 2016 there were a total of 15 KPC-*Kq* isolates from 8 patients and 17 environmental isolates from 11 rooms. The mean number of resistance genes identified in patients and environmental isolates were 15 and 14, respectively (P = NS), with five resistance genes carried by all isolates including bla_{KPC}. There was an average of 4.4 unique incompatibility types from patients and 4.0 from the environment (P = NS). For the longitudinal subset, there were 17 related isolates from two patients and two sink drains. One hospitalized patient with repeated antimicrobial exposure had a KPC-Kq initial isolate with 3 plasmid types and 13 AMR genes and died one year later with a KPC-Kq isolated from blood with 11 plasmid types and 25 AMR genes. The other patient was primarily an outpatient with little antimicrobial exposure. His KPC-*Kq* lost 1 plasmid and 3 AMR genes over 15 months. One KPC-*Kq* strain in the environment lost 3 plasmid types and 8 AMR genes over 4 months; the other was unchanged over 5 months.

Conclusion. KPC-*Kq* has been seen in both patients and the environment for several years at our institution. Sequencing of longitudinal isolates revealed that under antimicrobial pressure a patient KPC-*Kq* accumulated multiple plasmids and AMR genes. This same accumulation was not witnessed environmental sites over time although the numbers are small and will require confirmatory work.

Disclosures. **All authors:** No reported disclosures.

506. Urinary Catheters Are Associated with Progression from Bacteriuria to Invasive Infections in Patients with Carbapenem-Resistant Enterobacteriaceae, Metropolitan Atlanta, 2011–2017

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Session: 54. HAI: MDRO – GNR Epidemiology, CRE
Thursday, October 3, 2019: 12:15 PM

Background. Patients with carbapenem-resistant Enterobacteriaceae (CRE) bacteriuria have better outcomes than patients with an invasive CRE infection, but patients with bacteriuria may subsequently develop an invasive infection ("progression"). We sought to evaluate risk factors, particularly urinary catheters, for progression from CRE bacteriuria to an invasive CRE infection within one year.

Methods. We used population-based active surveillance data from the Georgia Emerging Infections Program to identify patients in metropolitan Atlanta with CRE in urine, but not in a concomitant or previous sterile site between August 1, 2011 and July 31, 2017. CRE was defined as an isolate resistant to tested third-generation cephalosporins and a minimum inhibitory concentration of ≥4 µg/mL for meropenem, doripenem or imipenem. We then assessed if these patients developed an invasive CRE infection (positive sterile site culture) with the same organism between one day and one year later. Demographics, culture site, comorbidities, and risk factors were obtained by chart review. Univariable analyses and multivariable logistic regression with progression as the outcome were performed in SAS 9.4.

Results. We identified 551 patients with CRE bacteriuria in 6 years, with an annual incidence of 1.1 cases/100,000 population. Many patients previously resided in long-term care facilities (48%), had a Charlson comorbidity index (CCI) >3 (38%), a central venous catheter (CVC, 34%) or a decubitus ulcer (27%, Table 1). Twenty-five patients (5%) progressed from CRE bacteriuria to an invasive CRE infection within one year (median 34 days). Predictors of progression in univariable analyses included the presence of a urinary catheter (OR 6.4 [95% CI: 1.9–21.6]), decubitus ulcer, CVC or other indwelling device, *Klebsiella pneumoniae*, black race, CCI >3, and ICU stay after urine culture was obtained (Table 2). In a multivariable analysis, urinary catheter (OR 4.6 [95% CI: 1.3–16.1]) predicted progression as well as *K. pneumoniae*, CCI >3 and CVC.

Conclusion. Progression from CRE bacteriuria to an invasive CRE infection is rare but clinically significant and is associated with urinary catheters. Future interventions should target urinary catheter removal, where possible, in patients with CRE bacteriuria.

Table 1: Demographics of patients with CRE bacteriuria in metropolitan Atlanta stratified by the presence of a urinary catheter

	Total (n = 507)[1]	No urinary catheter (n = 227)	Urinary catheter[2] (n = 280)	P-value[3]
Age (mean years, SD)	63.5 (17.9)	65.2 (18.0)	62.1 (17.4)	0.05
Female (n = 506)	286 (57)	147 (65)	139 (50)	<0.001
Race (n = 480)				0.04
White	166 (35)	85 (40)	81 (30)	
Black	301 (63)	120 (57)	181 (68)	
Other	13 (3)	7 (3)	6 (2)	
Charlson comorbidity index >3 (n =504)	189 (38)	87 (39)	102 (36)	0.58
Decubitus ulcer	173 (34)	47 (21)	126 (45)	<0.001
Central venous catheter[2]	137 (27)	32 (14)	105 (38)	<0.001
Other indwelling device[2,4]	177 (35)	48 (21)	129 (46)	<0.001
Organism				<0.001
Klebsiella pneumoniae	334 (66)	126 (56)	208 (74)	
Escherichia coli	102 (20)	67 (30)	35 (13)	
Enterobacter cloacae	43 (9)	20 (9)	23 (8)	
Klebsiella aerogenes	17 (3)	9 (4)	8 (3)	
Klebsiella oxytoca	11 (2)	5 (2)	6 (2)	
Patient location 4 days prior to culture (n = 500)				<0.001
Inpatient	84 (17)	20 (9)	64 (23)	
LTCF/LTACH	238 (48)	95 (43)	143 (51)	
Private residence	178 (36)	106 (48)	72 (26)	
ICU prior to the culture[5] (n = 496)	59 (12)	6 (3)	53 (19)	<0.001
ICU after the culture[5] (n = 500)	109 (22)	22 (10)	87 (31)	<0.001

All values are presented as number (%) unless otherwise stated
1. Only patients that had chart review data available
2. At the time culture was obtained or in the 2 prior calendar days
3. Comparison of patients with and without a urinary catheter. Categorical variables were analyzed by Chi-square tests and continuous variables were analyzed by Student's t-tests
4. Endotracheal tube, gastrostomy tube, nasogastric tube, tracheostomy, or nephrostomy tube
5. Any time in the 7 days (before or after) the culture was obtained
Abbreviations: LTCF, long term care facility; LTACH, long term acute care hospital; ICU, intensive care unit

Table 2: Risk factors for progression to an invasive CRE infection

	No progression (n = 482)	Progression (n = 25)	Univariable OR (95% CI)	Multivariable OR (95% CI)
Age (mean years, SD)	63.5 (17.6)	62.9 (19.6)	1.0 (0.98 – 1.02)	
Female (n = 506)	273 (57)	13 (52)	0.8 (0.4 – 1.9)	
Race (n = 467)				
Black	280 (63)	21 (84)	3.0 (1.03 – 9.0)	
White	162 (37)	4 (16)	--	
Charlson comorbidity index > 3 (n = 504)	174 (36)	15 (60)	2.6 (1.2 – 6.0)	3.0 (1.3 – 7.1)
Decubitus ulcer	159 (33)	14 (56)	2.6 (1.2 – 5.8)	
Urinary catheter[1]	258 (54)	22 (88)	6.4 (1.9 – 21.6)	4.6 (1.3 – 16.1)
Central venous catheter[1]	122 (25)	15 (60)	4.4 (1.9 – 10.1)	2.8 (1.2 – 6.6)
Other indwelling device[1,3]	161 (33)	16 (64)	3.6 (1.5 – 8.2)	
Organism				
K. pneumoniae	310 (64)	24 (96)	13.3 (1.8 – 99.3)[2]	9.7 (1.3 – 73.7)[2]
E. coli	101 (21)	1 (4)	--	
E. cloacae	43 (9)	0 (0)	--	
K. aerogenes	17 (4)	0 (0)	--	
K. oxytoca	11 (2)	0 (0)	--	
Patient location 4 days prior to culture (n = 500)				
Inpatient	78 (16)	6 (24)	2.7 (0.8 – 9.0)	
LTCF/LTACH	224 (47)	14 (56)	2.2 (0.8 – 6.1)	
Private residence or homeless	173 (36)	5 (20)	--	
ICU prior to culture[4] (n = 496)	53 (11)	6 (24)	2.5 (0.95 - 6.5)	
ICU after culture[4] (n = 500)	97 (20)	12 (48)	3.6 (1.6 – 8.1)	

All values are presented as number (%) unless otherwise stated
1. At the time culture was obtained or in the 2 prior calendar days
2. Odds ratio is for *Klebsiella pneumoniae* versus any other organism
3. Endotracheal tube, gastrostomy tube, nasogastric tube, tracheostomy, or nephrostomy tube
4. Any time in the 7 days (before or after) the culture was obtained
Abbreviations: OR, odds ratio; CI, confidence interval; LTCF, long term care facility; LTACH, long term acute care hospital; ICU, intensive care unit

Disclosures. **All authors:** No reported disclosures.