

Title: Utilization of colistin versus β -lactam and β -lactamase inhibitor agents in relation to acute kidney injury in patients with severe gram-negative infections

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Supplementary Material

Supplementary Table 1. Sepsis, ventilation, dialysis procedures, ARF, and CF Codes

	Code	Code Type	Description
Sepsis	3.1	ICD-9	SEPTICEMIA, SALMONELLA
	20.2		PLAGUE, SEPTICEMIC
	22.3		ANTHRAX SEPTICEMIA
	38		SEPTICEMIA*
	38		SEPTICEMIA, STREPTOCOCCAL
	38.1		STAPHYLOCOCC SEPTICEMIA*
	38.1		SEPTICEMIA, STAPHYLOCOCCAL NOS
	38.11		SEPTICEMIA, MSSA STAPH AUREUS
	38.12		SEPTICEMIA, MRSA RESIS STAPH AUREUS
	38.19		SEPTICEMIA, STAPHYLOCOCCAL NEC
	38.2		SEPTICEMIA, PNEUMOCOCCAL
	38.3		SEPTICEMIA, ANAEROBIC
	38.4		GRAM-NEG SEPTICEMIA NEC*
	38.4		SEPTICEMIA, GRAM-NEG ORGANISM NOS
	38.41		SEPTICEMIA, HEMOPHILUS INFLUENZAE
	38.42		SEPTICEMIA, E. COLI
	38.43		SEPTICEMIA, PSEUDOMONAS
	38.44		SEPTICEMIA, SERRATIA
	38.49		SEPTICEMIA, GRAM-NEG ORGANISM NEC
	38.8		SEPTICEMIA NEC
	38.9		SEPTICEMIA NOS

54.5		HERPETIC SEPTICEMIA
415.12		SEPTIC PULMONARY EMBOLISM
422.92		MYOCARDITIS, SEPTIC
449		SEPTIC ARTERIAL EMBOLISM
659.3		SEPTICEMIA DURING LABOR*
659.3		SEPTICEMIA IN LABOR, UNSPE
659.31		SEPTICEMIA IN LABOR, DELIVERED
659.33		SEPTICEMIA IN LABOR, ANTEPARTUM
670.2		PUERPERAL SEPSIS, UNSPE
670.22		PUERPERAL SEPSIS, DELIVERED W/PP
670.24		PUERPERAL SEPSIS, POSTPARTUM
670.3		PUERPRL SEPTIC THROMBOPHLEB, UNSPE
670.32		PUERPERL SEPTIC THROMBOPHLEB,DEL+PP
670.34		PUERPERAL SEPTIC THROMBOPHLEB, PP
673.3		OB PYEMIC/SEPTIC EMBOL*
673.3		EMBOLISM, OB PYEMIC/SEPTIC, UNSPE
673.31		EMBOLISM, OB PYEMIC/SEPTIC, DEL
673.32		EMBOLISM, OB PYEMIC/SEPTIC, DEL +PP
673.33		EMBOLISM, OB PYEMIC/SEPTIC, ANTPRT
673.34		EMBOLISM, OB PYEMIC/SEPTIC, PP
785.52		SYMPTOM, SHOCK, SEPTIC
995.91		ADVEF SIRS D/T SEPSIS
995.92		ADVEF SIRS D/T SEVERE SEPSIS
998.02		SHOCK, POSTOPERATIVE, SEPTIC
A02.1		SALMONELLA SEPSIS
A20.7	ICD-10	

A22.7	SEPTICEMIC PLAGUE
A26.7	ANTHRAX SEPSIS
A32.7	ERYSIPELOTHRIX SEPSIS
A40	LISTERIAL SEPSIS
A40.0	STREPTOCOCCAL SEPSIS
A40.1	SEPSIS D/T STREPTOCOCCUS, GROUP A
A40.3	SEPSIS D/T STREPTOCOCCUS, GROUP B
A40.8	SEPSIS D/T STREPTOCOCCUS PNEUMONIAE
A40.9	OTHER STREPTOCOCCAL SEPSIS
A41	STREPTOCOCCAL SEPSIS, UNSPECIFIED
A41.0	OTHER SEPSIS
A41.01	SEPSIS DUE TO STAPHYLOCOCCUS AUREUS
A41.02	
A41.1	SEPSIS D/T METHCLLN SUSCPT STAPHYL
A41.2	SEPSIS D/T METHCLLN RESIST STAPHYL
A41.3	SEPSIS D/T OTHR SPEC STAPHYLOCOCCUS
A41.4	SEPSIS D/T UNSPECIF STAPHYLOCOCCUS
A41.5	SEPSIS DUE TO HEMOPHILUS INFLUENZAE
A41.50	SEPSIS DUE TO ANAEROBES
A41.51	SEPSIS D/T OTHER GRAM-NEG ORGANISMS
A41.52	GRAM-NEGATIVE SEPSIS, UNSPECIFIED
A41.53	SEPSIS DUE TO E. COLI
A41.59	SEPSIS DUE TO PSEUDOMONAS
A41.8	SEPSIS DUE TO SERRATIA
A41.81	OTHER GRAM-NEGATIVE SEPSIS
A41.89	OTHER SPECIFIED SEPSIS

A41.9	SEPSIS DUE TO ENTEROCOCCUS
A42.7	OTHER SPECIFIED SEPSIS
A54.86	SEPSIS, UNSPECIFIED ORGANISM
B37.7	ACTINOMYCOTIC SEPSIS
I26.01	GONOCOCCAL SEPSIS
I26.90	CANDIDAL SEPSIS
I76	SEPTIC PUL EMB W ACUTE COR PULMONAL
O03.37	SEPTIC PUL EMB W/O ACUTE COR PULMON
O03.87	SEPTIC ARTERIAL EMBOLISM
O04.87	SEPSIS FG INCOMPLETE SPONT ABORTION
O07.37	SEPSIS FG COMPLETE/UNS SPONTS ABRTN
O08.82	SEPSIS FG (INDCD)TERMN OF PREGNANCY
O85	SEPSIS FG FAILD ATTMP TERMTN PREGNA
O86.04	SEPSIS FG ECTOPIC & MOLAR PREGNANCY
O86.81	PUERPERAL SEPSIS
O88.3	SEPSIS FOLLOW OBSTETRICAL
O88.31	PROCEDURE
O88.311	PUERPERAL SEPTIC THROMBOPHLEBITIS
O88.312	OBSTETRIC PYEMIC & SEPTIC EMBOLISM
O88.313	PYEMIC & SEPTIC EMBOLISM, PREGNANCY
O88.319	PYEMIC&SEPTIC EMBOLISM,PREG,1ST TRI
O88.32	PYEMIC&SEPTIC EMBOLISM,PREG,2ND TRI
O88.33	PYEMIC&SEPTIC EMBOLISM,PREG,3RD TRI
R65.2	PYEMIC&SEPTIC EMBOLISM,PREG,UNS TRI
R65.20	PYEMIC & SEPTIC EMBOLISM,CHILDBIRTH
R65.21	

	T81.12 T81.12X T81.12XA T81.12XD T81.12XS T81.44XA T81.44XD T81.44XS		PYEMIC&SEPTIC EMBOLISM, PUERPERIUM SEVERE SEPSIS SEVERE SEPSIS WITHOUT SEPTIC SHOCK SEVERE SEPSIS WITH SEPTIC SHOCK POSTPROCEDURAL SEPTIC SHOCK POSTPROCEDURAL SEPTIC SHOCK POSTPROCEDURAL SEPTIC SHOCK,IE POSTPROCEDURAL SEPTIC SHOCK,SE POSTPROCEDURAL SEPTIC SHOCK,SEQ SEPSIS FOLLOWING A PROCEDURE,IE SEPSIS FOLLOWING A PROCEDURE,SE SEPSIS FOLLOWING A PROCEDURE,SQ
Ventilation	270270086600000 270270088900000 270270089300000 290290093620000 410410940040000 410410940050000 410412000580000 410412000590000 410412000600000 410412000610000 410412000620000 410412000630000 410412000640000 410412946560000	Charge/Billing Codes	VENTILATOR HI FREQUENCY SETUP VENTILATOR SETUP VENTILATOR PRESSURE SETUP VENTILATOR EQUIPMENT PER DAY VENTILATOR NURSING FACILITY PER DAY VENTILATOR MANAGEMENT CARE PLAN IN HOME VENTILATION MANUAL 15 MIN VENTILATOR ASSESSMENT VENTILATOR MAINTENANCE VENTILATOR STANDBY VENTILATOR TRANSPORT VENTILATOR VOLUME MONITOR VENTILATOR WEANING PARAMETERS

	410412946560001 410412946570000 410412946570002 410412946570003 410412946570004 410412946570005 410412946570007 410412946570009 410412946620000		VENTILATION ASST & MANAGEMENT FIRST DAY 94002 VENTILAT ASST & MANAGEMENT INIT SHIFT(8HRS) 94002 VENTILATION ASST & MANAGEMENT SUBSEQUENT DAY 94003 VENTILATION ASST & MANAGE SHIFT INFANT(8HRS)94003 VENTILATION ASST & MANAGEMENT PER HR 94003 *VENTILATOR HI FREQUENCY PER HR *VENTILATOR 3 HR VENTILATOR PER SHIFT (8HRS) 94003 VENTILATOR PER HR 94003 CNP INITIATION/MANAGEMENT
Dialysis procedures	800800000040000 800800000050000 800800000080000 800800000090000 800800909180000 800800909190000 800800909200000 800800909210000 800800909220000 800800909230000 800800909240000 800800909250000 800800909510000	Charge/Billing Codes	DIALYSIS CALLBACK FEE DIALYSIS CHRONIC RENAL DIALYSIS INCOMPLETE PROCEDURE DIALYSIS PORTABLE FEE ESRD SERVICES PER MONTH < 2 YRS ESRD SERVICES PER MONTH 2-11 YRS ESRD SERVICES PER MONTH 12-19 YRS ESRD SERVICES PER MONTH > 20 YRS ESRD SERVICES PER DAY < 2 YRS ESRD SERVICES PER DAY 2-11 YRS ESRD SERVICES PER DAY 12-19 YRS ESRD SERVICES PER DAY > 20 YRS ESRD SERVICES < 2 YRS W/ 4+ VISITS PER MONTH

800800909520000	ESRD SERVICES < 2 YRS W/ 2-3 VISITS PER MONTH
800800909530000	ESRD SERVICES < 2 YRS W/ 1 VISIT PER MONTH
800800909540000	ESRD SERVICES 2-11 YRS W/ 4+ VISITS PER MONTH
800800909550000	ESRD SERVICES 2-11 YRS W/ 2-3 VISITS PER MONTH
800800909560000	ESRD SERVICES 2-11 YRS W/ 1 VISIT PER MONTH
800800909570000	ESRD SERVICES 12-19 YRS W/ 4+ VISITS PER MONTH
800800909580000	ESRD SERVICES 12-19 YRS W/ 2-3 VISITS PER MONTH
800800909590000	ESRD SERVICES 12-19 YRS W/ 1 VISIT PER MONTH
800800909600000	ESRD SERVICES > 20 YRS W/ 4+ VISITS PER MONTH
800800909610000	ESRD SERVICES > 20 YRS W/ 2-3 VISITS PER MONTH
800800909620000	ESRD SERVICES > 20 YRS W/ 1 VISIT PER MONTH
800800909630000	ESRD SERVICES < 2 YRS HOME DIALYSIS 1 MONTH
800800909640000	ESRD SERVICES 2-11 YRS HOME DIALYSIS 1 MONTH
800800909650000	ESRD SERVICES 12-19 YRS HOME DIALYSIS 1 MONTH
800800909660000	ESRD SERVICES > 20 YRS HOME DIALYSIS 1 MONTH
800800909670000	ESRD SERVICES < 2 YRS DIALYSIS PER DAY
800800909680000	ESRD SERVICES 2-11 YRS DIALYSIS PER DAY
800800909690000	
800800909700000	
800800909890000	
800800909930000	
800800909970000	
800800909990000	
800800909990001	
800801909350000	
800801909350001	

	800802909450000	ESRD SERVICES 12-19 YRS DIALYSIS PER DAY
	800802909450001	ESRD SERVICES >20 YRS DIALYSIS PER DAY
	800802909470000	
	800803000060000	DIALYSIS TRAINING INPATIENT COMPLETE
	800804000070000	DIALYSIS TRAINING INPATIENT INCOMPLETE
	800821002570000	
	800821909350000	HEMOPERFUSION PROCEDURE I/P
	800821909370000	DIALYSIS PROCEDURE UNLISTED
	800880000100000	DIALYSIS MISC
	800880909390000	HEMODIALYSIS PROCEDURE I/P 1 EVAL
	800880909400000	HEMODIALYSIS PROCEDURE I/P PER HR
	800881000020000	DIALYSIS PROC OTH THAN HEMODIALYSIS W/SING EVAL
	800881000030000	DIALYSIS PROC OTH THAN HEMODIAL W/SING EVAL P/HR
		DIALYSIS PROC OTH THAN HEMODIAL REQ REPEATED EVALS
		*DIALYSIS CAPD INPATIENT
		*DIALYSIS CCPD INPATIENT
		DIALYSIS UNSCH/EMERG FOR ESRD PATIENT O/P NOT CERT
		HEMODIALYSIS PROCEDURE O/P 1 EVAL
		HEMODIALYSIS PROCEDURE REPEAT EVAL W/WO REV PRESCR
		DIALYSIS OUTSIDE FACILITY
		HEMODIALYSIS ACCESS FLOW STUDY TRANSCUTANEOUS
		HEMODIALYSIS ACCESS FLOW STUDY
		*HEMOFILTRATION 1ST HR

			*HEMOFILTRATION ADDL HR
Acute Renal Failure	584.5	ICD-9	Acute kidney failure with lesion of tubular necrosis convert
	584.6		Acute kidney failure with lesion of renal cortical necrosis convert
	584.7		Acute kidney failure with lesion of renal medullary [papillary] necrosis
	584.8		Acute kidney failure with other specified pathological lesion in kidney
	584.9		Acute kidney failure, unspecified
	N17.0	ICD-10	Acute kidney failure with tubular necrosis
	N17.1		Acute kidney failure with acute cortical necrosis
	N17.2		Acute kidney failure with medullary necrosis
	N17.8		Other acute kidney failure
	N17.9		Acute kidney failure, unspecified
Cystic Fibrosis	277.0	ICD-9	CYSTIC FIBROSIS*
	277.00		CYSTIC FIBROSIS W/O MECONIUM ILEUS
	277.01		CYSTIC FIBROSIS W/MECONIUM ILEUS
	277.02		CYSTIC FIBROSIS W/PULMONARY MNFST
	277.03		CYSTIC FIBROSIS W/GI MANIFESTATIONS
	277.09		CYSTIC FIBROSIS W/OTHER MNFST
	E84	ICD-10	CYSTIC FIBROSIS
	E84.0		CYSTIC FIBROSIS W PULMONARY MANIFEST
	E84.1		CYSTIC FIBROSIS W INTESTINAL MANIFS
	E84.11		MECONIUM ILEUS IN CYSTIC FIBROSIS
	E84.19		CYSTC FIBROSIS W OTH INTESTNL MANFS
	E84.8		CYSTC FIBROSIS W OTH MANIFESTATIONS
	E84.9		

			CYSTIC FIBROSIS, UNSPECIFIED
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Supplementary Table 3. Medications associated with renal injury[24]

Medication
acyclovir
adefovir
amphotericin
aminoglycoside agents
carboplatin
celecoxib
cyclophosphamide
cyclosporine
dopamine
efavirenz
emtricitabine
epinephrine
furosemide
indinavir
iodixanol
iohexol
lithium
methotrexate
netilmicin
norepinephrine
paromomycin
streptomycin
tacrolimus
tenofovir
vancomycin

Supplementary Table 4 Pathogen distribution by treatment

Treatment Cohort	Index_pathogen	Number
Colistin	Achromobacter undifferentiated	2
Colistin	Achromobacter xylosoxidans	1
Colistin	Acinetobacter	1
Colistin	Acinetobacter baumannii	71
Colistin	Acinetobacter lwoffii	1
Colistin	Alcaligenes xylosoxidans	2
Colistin	Citrobacter amalonaticus	1
Colistin	Citrobacter freundii	2
Colistin	Enterobacter aerogenes	5
Colistin	Enterobacter cloacae	3
Colistin	Escherichia coli	10
Colistin	Haemophilus influenzae	1
Colistin	Klebsiella pneumoniae	39
Colistin	Morganella morganii	1
Colistin	Proteus mirabilis	5
Colistin	Proteus undifferentiated	2
Colistin	Providencia alcalifaciens	1
Colistin	Providencia stuartii	1
Colistin	Pseudomonas	1
Colistin	Pseudomonas aeruginosa	96
Colistin	Serratia marcescens	2
Colistin	Stenotrophomonas maltophilia	8

BL+BLI	Acinetobacter baumannii	10
BL+BLI	Enterobacter aerogenes	2
BL+BLI	Enterobacter cloacae	5
BL+BLI	Escherichia coli	24
BL+BLI	Haemophilus influenzae	1
BL+BLI	Klebsiella oxytoca	1
BL+BLI	Klebsiella pneumoniae	38
BL+BLI	Moraxella catarrhalis	1
BL+BLI	Proteus mirabilis	6
BL+BLI	Proteus undifferentiated	1
BL+BLI	Providencia rettgeri	1
BL+BLI	Providencia stuartii	2
BL+BLI	Pseudomonas	2
BL+BLI	Pseudomonas aeruginosa	157
BL+BLI	Pseudomonas fluorescens/putida	1
BL+BLI	Pseudomonas undifferentiated	1
BL+BLI	Stenotrophomonas maltophilia	3

Supplementary Table 5. Variables used for the final AKI model

Final Model Variables	OR Estimates	Lower 95% CI	Upper 95% CI	P-Value
Intercept				
Treatment (Colistin vs. New Agents) @ Renal Disease = Yes	1.98	0.77	5.10	0.1556
Treatment (Colistin vs. New Agents) @ Renal Disease = No	3.69	1.84	7.42	0.0002
ICU at ANY Point	3.94	2.17	7.16	<.0001
Congestive Heart Failure	2.17	1.25	3.77	0.0058
Peripheral Vascular Disease	2.55	1.27	5.14	0.0086
Dementia	0.29	0.08	1.04	0.0579
Mild Liver Disease	4.31	1.54	12.07	0.0054
Diabetes and Chronic Complications	2.44	1.15	5.16	0.0196